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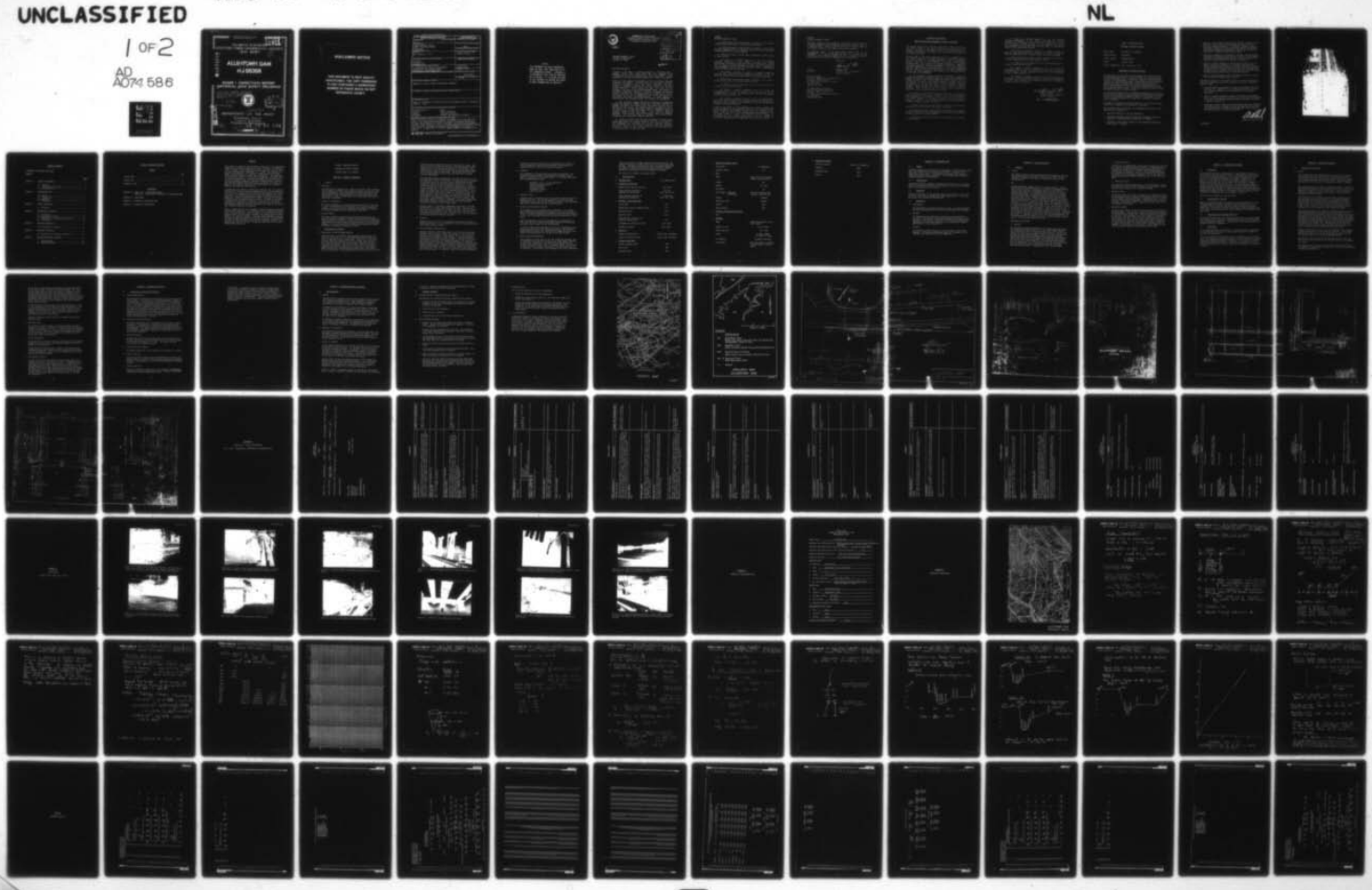

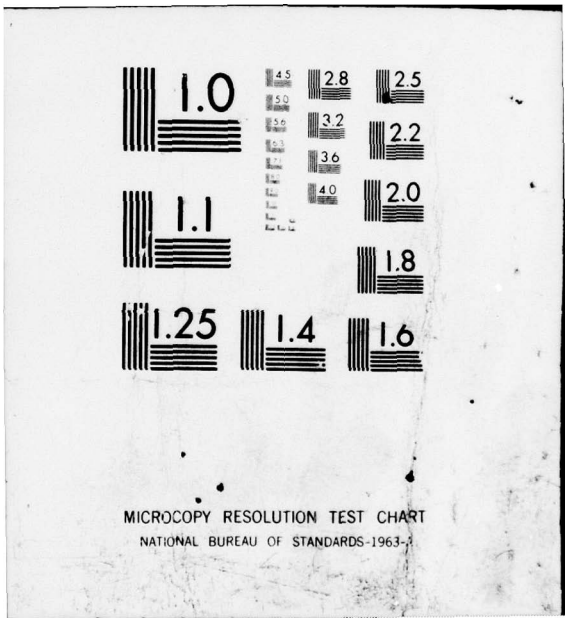
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LEVEL II

DELAWARE RIVER BASIN
DOCTORS CREEK, MONMOUTH COUNTY
NEW JERSEY

ALLENTOWN DAM
NJ 00308

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Allentown Dam (NJ-00308). Delaware River Basin. Doctors Creek, Monmouth County, New Jersey. Phase 1 Inspection Report.

(9) Final rept.,

(15) DACW61-79-C-0011

(10) Anthony G. Posch

DEPARTMENT OF THE ARMY
Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

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REPORT DOCUMENTATION PAGE

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Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Allentown Dam, N.J.	Dams
Spillways	Visual Inspection
Seepage	Structural Analysis
Embankment	National Dam Inspection Act Report

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

25 SEP 1979

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Allentown Dam in Monmouth County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Allentown Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillway is considered inadequate since seven percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood). The spillway is considered "inadequate" instead of "seriously inadequate" because dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability. This should include test borings to determine material properties relative to stability. Any remedial measures found necessary should be initiated within calendar year 1980.

c. Within thirty days from the date of approval of this report, ownership of the dam should be conclusively established.

d. Within three months from the date of approval of this report, the owner should develop and implement formal operational procedures containing guidelines on gate operation.

e. Within six months from the date of approval of this report, the owner should:

(1) Carry out remedial measures to the dam structure including replacement of the timber stop-planks and slides; underpinning of retaining walls with concrete; replacement of eroded fill to a slope of 2H:1V; provision of a safe means of lowering the lake; blockage of the millrace with concrete; repair of deteriorated concrete facing and masonry pointing.

(2) Develop a program to monitor the seepage through and under the dam. Depending on the information provided, the need for corrective measures can be considered and, if necessary, undertaken.

f. Within twelve months from the date of approval of this report, the owner should take the following remedial actions:

(1) Remove trees and vegetation from the downstream areas of sloping fill and seed with grass.

(2) Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam. Annotate and update the existing drawings to form a coherent as-built set.

(3) Initiate a program of annual inspection and maintenance. This should include lowering the lake and updating the operation and maintenance log. Movement of the embankment should also be monitored by means of surveying monuments.

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Frank Thompson Jr. of the Fourth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

NAPEN-D
Honorable Brendan T. Byrne

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
Bureau of Flood Plain Management
Division of Water Resources
N.J. Dept. of Environmental Protection
P.O. Box CN029
Trenton, NJ 08625

ALLENTOWN DAM (NJ00308)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 1 May and 1 June 1979 by Frederic R. Harris, Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Allentown Dam, a high hazard potential structure, is judged to be in fair overall condition. The dam's spillway is considered inadequate since seven percent of the Spillway Design Flood--SDF - would overtop the dam. (The SDF, in this instance, is one half of the Probable Maximum Flood). The spillway is considered "inadequate" instead of "seriously inadequate" because dam failure resulting from overtopping would not significantly increase the hazard to loss of life downstream from the dam from that which would exist just before overtopping failure. To insure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures, and studies within six months from the date of approval of this report. Any remedial measures necessary to insure the adequacy of the spillway and to prevent overtopping should be initiated within calendar year 1980. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around the clock surveillance should be provided.

b. Within six months from the date of approval of this report, engineering studies and analyses should be performed to determine the dam's embankment and foundation condition and structural stability. This should include test borings to determine material properties relative to stability. Any remedial measures found necessary should be initiated within calendar year 1980.

c. Within thirty days from the date of approval of this report, ownership of the dam should be conclusively established.

d. Within three months from the date of approval of this report, the owner should develop and implement formal operational procedures containing guidelines on gate operation.

e. Within six months from the date of approval of this report, the owner should:

(1) Carry out remedial measures to the dam structure including replacement of the timber stop-planks and slides; underpinning of retaining walls with concrete; replacement of eroded fill to a slope of 2H:1V; provision of a safe means of lowering the lake; blockage of the millrace with concrete; repair of deteriorated concrete facing and masonry pointing.

(2) Develop a program to monitor the seepage through and under the dam. Depending on the information provided, the need for corrective measures can be considered and, if necessary, undertaken.

f. Within twelve months from the date of approval of this report, the owner should take the following remedial actions:

(1) Remove trees and vegetation from the downstream areas of sloping fill and seed with grass.

(2) Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam. Annotate and update the existing drawings to form a coherent as-built set.

(3) Initiate a program of annual inspection and maintenance. This should include lowering the lake and updating the operation and maintenance log. Movement of the embankment should also be monitored by means of surveying monuments.

APPROVED: James G. Ton
JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 22 Sep 1979

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam: Allentown, I.D. NJ00308

State Located: New Jersey

County Located: Monmouth County

Stream: Doctors Creek

Date of Inspection: May 1 and June 1, 1979

Assessment of General Condition

Allentown Dam is an earth-fill road embankment with retaining walls. It is approximately 300 feet long and 18 feet high, and has a gated spillway with timber gates. The general condition of Allentown Dam is fair. The dam embankments appear to be stable, but have undergone considerable surface deterioration. Timber stop-planks in the spillway structure are leaking and their structural adequacy is in doubt. Minor erosion of fill has occurred at and under the toe of the downstream retaining walls. There is no operable low-level outlet. The hazard potential is rated as "high."

The safety of Allentown Dam is considered questionable in view of its lack of spillway capacity to pass one half the PMF without overtopping the dam. The spillway is capable of passing a flood equal to 3% of the PMF without overtopping of the dam and is therefore considered to be "inadequate."

At present, the engineering data available is not sufficient to make a definitive statement on the stability of the dam.

The following actions, therefore, are recommended along with a time-table for their completion.

1. Establish ownership of the dam immediately.

2. Develop and implement formal operational procedures containing guidelines on gate operation within three (3) months.

3. Establish a flood warning system for the downstream communities within three (3) months.

4. Carry out a more precise hydrologic and hydraulic analysis of the dam within six (6) months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages.

5. Carry out a program of soil borings on the dam. Log the borings to determine engineering properties of the dam fill and foundation materials. This program and a stability analysis based on the findings should be completed within six (6) months.

6. Carry out remedial measures to the dam structure within six (6) months, including replacement of the timber stop-planks and slides; underpinning of retaining walls with concrete; replacement of eroded fill to a slope of 2H:1V; provision of a safe means of lowering the lake; blockage of the mill-race with concrete; repair of deteriorated concrete facing and masonry pointing.

7. Remove trees and vegetation from the downstream areas of sloping fill and seed with grass within 12 months.

Furthermore, while of a less urgent nature, the following additional action is recommended and should be carried out within a reasonable period of time.

1. A program should be developed to monitor the seepage through and under the dam. Depending on the information provided, the need for corrective measures can be considered and, if necessary, undertaken.

2. Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections of the dam. Annotate and update the existing drawings, and form a coherent as-built set.

3. A program of annual inspection and maintenance should be initiated. This should include lowering the lake, and updating the operation and maintenance log. Movement of the embankment should also be monitored by means of surveying monuments.

Anthony G. Posch, P.E.

AGP/REJ/ak

Allentown Dam
Overall view of dam from upstream.

June 1, 1979

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PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Allentown Dam, I.D. NJ00308

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The National Dam Inspection Act (Public Law 92-367, 1972) provides for the National Inventory and Inspection Program by the U.S. Army Corps of Engineers. This inspection was made in accordance with this authority under Contract C-FPM No. 35 with the State of New Jersey who, in turn is contracted to the Philadelphia District of the Corps of Engineers.

b. Purpose of Inspection

The visual inspection of Allentown Dam was made on May 1 and June 1, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

The report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an evaluation of hydrologic and hydraulic conditions at the site; presents an evaluation as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

1.2 Description of Project

a. Description of Dam and Appurtenances

Allentown Dam is an earthfill road embankment approximately 300 feet long and 18 feet high, with masonry and concrete retaining walls on upstream and downstream faces. There is a 37 foot wide spillway structure towards the left of the dam, which consists of a vertical concrete frame of 8 portals, fitted with slides to accomodate stop-planks. The frame is flush with the upstream retaining wall and is braced at each column with concrete raker beams anchored into the downstream spillway apron. The upper 2 feet of stop-planks at each opening have been fitted with a lifting

frame for manual operation, and constitute control gates. The dam forms part of South Main Street, a two-lane paved road which passes over a steel and concrete bridge at the spillway. The spillway apron is of concrete construction and runs horizontally under the full width of the bridge. The bridge abutments form the spillway wingwalls, and confine the flow after it passes over the stop-planks.

The embankment extends approximately 100 feet to the left of the spillway and 150 feet to the right. The upstream face is retained by a masonry wall with concrete facing, which arches slightly towards the reservoir and terminates at sidewalk level. The downstream side of the dam is of mixed construction: adjacent to the spillway the fill is retained by arched masonry walls with concrete rendering; to the left of the arched section the fill slopes at steeper than 2H:1V with assorted rip-rap walls; to the right, the fill slopes a 2H:1V down to a concrete wall and the dam terminates on the right side of the old mill building. A heavy growth of trees is covering the sloping fill at both ends of the dam. The embankment carries, for its full length, overhead power cables on pylons, a watermain, a gas main, handrailing and traffic barriers. Storm drains from the road discharge through the retaining walls on both sides.

Doctors Creek is a wide basin immediately downstream of the dam, and narrows to a formal channel within 150 feet. The old mill works are still in existence, but are not used. The mill consists of a four story building on the right side of the dam with associated machinery and mill-race. The mill-race, not now operable, is the only low-level outlet to the dam.

b. Location

Allentown Dam is located in the Borough of Allentown, Monmouth County, New Jersey. It is accessible by means of South Main Street which passes across the dam.

c. Size and Hazard Classification

Allentown Dam has a structural height of 18 feet and a reservoir storage of 496 acre-feet. Since its storage is less than 1,000 acre-feet and its height is less than 40 feet, it is classified in the dam size category as being "small." A hazard potential classification of "high" has been assigned to the dam on the basis that failure would result in excessive damage to the road and services across the dam and to downstream property, including the Sewage Treatment Plant. Because the road across the dam is heavily traveled, and because the lake is used for recreational purposes, the possibility exists of the loss of more than a few lives in the event of dam failure. In addition, there are several inhabitable

buildings within the flood path, and overtopping or failure of the dam under SDF conditions would submerge the buildings or erode the banks on top of which they are situated.

d. Ownership

The ownership of Allentown Dam has not been established. The bridge and road are owned and maintained by Monmouth County. After the decease of the original owner, J. R. Conine, the County has also maintained the dam.

Attention: Mr. C. N. Van Benschoten
Assistant County Engineer
Board of Freehold
1 Lafayette Place
Freehold, NJ 07728
(201) 431-7760

e. Purpose of Dam

Allentown Dam was originally built to provide a head of water for powering the mill. Its present purpose is to store water for agricultural irrigation, to control flood damage to the downstream area and to retain the lake for recreational use.

f. Design and Construction History

No information on the original dam is available. It is known that the bridge and spillway were washed out in 1920 following a storm. The present bridge and stop-plank structure were installed in 1921, and the arched retaining walls were constructed at that time.

The road adjacent to the mill was washed out by overtopping in 1947, and the newer concrete downstream retaining wall may have been built then, as part of the reinstatement.

In 1972 the gates were replaced, but it is not recorded when any replacement was made of the timber stop-planks. The Monmouth County Engineers Office has coordinated and approved most of the design and reconstruction of the dam in the last 40 years.

g. Normal Operating Procedures

The discharge from the lake is over the stop-plank spillway, and is regulated by raising one or more of the eight gates according to the stage. Operation of the gates is in the hands of the District Foreman of District No. 7, Monmouth County, who has been in charge for three years. Operation of the gates requires two or three men. In the event of an emergency, the local inhabitants

contact the District foreman through the Allentown Police; the operation team are on 24 hour call, but live several miles from the dam. No formal procedures have been established regarding the number of gates to be raised in order to prevent either flooding the downstream area or overtopping of the dam.

The lake is not lowered on a regular basis.

1.3 Pertinent Data

a. Drainage Area:	17.4 square miles
b. Discharge at Dam Site	
Maximum known flood at dam site:	Over road.
Gated spillway capacity at elevation of top of dam:	751 cfs (elev. 66.3' MSL)
Total spillway capacity at maximum pool elevation:	17,815 cfs (elev. 75.3' MSL)
c. Elevation (Feet above MSL)	
Top of dam:	66.3
Maximum pool design surcharge (SDF):	75.3
Recreation pool:	61.0
Spillway crest:	61.0
Lake overflow (low point of spillway, gates open):	59.0
Streambed at centerline of dam:	48.0 (est)
Maximum tailwater:	60.0 (est)
d. Reservoir	
Length of maximum pool:	4,500 ± feet (estimate)
Length of recreation pool:	3,000 ± feet (estimate)
e. Storage (Acre-feet)	
Design surcharge (SDF):	864
Top of dam:	496
Spillway crest:	341

f. Reservoir Surface (Acres)

Top of dam:	33 (estimated)
Spillway crest:	26

g. Dam

Type:	Earth fill with concrete/ masonry retaining walls.
Length:	300'
Height:	18' (est)
Top width:	34'
Side slopes - Upstream:	Vertical retaining wall.
- Downstream:	Vertical retaining wall.
Zoning:	Unknown
Impervious core:	Unknown
Cutoff:	None
Grout curtain:	None

h. Diversion and Regulating Tunnel

N/A

i. Spillway

Type:	Timber stop-planks on concrete frame.
Length of weir:	17.33' (net)
Crest elevation:	61.0' MSL
Gates:	8 gates, timber, 3'6" wide x 2' high
U/S Channel:	Allentown Mill-Pond
D/S Channel:	After the gates, a horizontal apron down to Doctor's Creek.

j. Regulating Outlets

Low-level outlet:	Mill-race (inoperable)
Controls:	None
Emergency gate:	None
Outlet:	None

SECTION 2: ENGINEERING DATA

2.1 Design

No design computations for the dam are available. Three drawings, dated 1920, give details of the bridge structure built to replace the one washed out by high water. No data from soil borings, soil tests or other geotechnical data are available. No cross-sections suitable for assessing stability are available.

2.2 Construction

Construction history available is presented in Section 1.2.f. No data exist of construction methods or borrow sources, nor other data pertinent to the construction of the dam.

2.3 Operation

Records of operation of the spillway gates can be obtained orally from Mr. Hulit, the District Foreman for County District No. 7. It is not known when the mill-race was blocked off.

2.4 Evaluation

a. Availability

The availability of engineering data is poor. The stated drawings and some correspondence on the dam were available from the NJDEP.

b. Adequacy

The engineering data available, together with that obtained in the field, were adequate to perform hydrologic and hydraulic computations. The data was insufficient to perform even approximate computations of the dam's stability, but an evaluation could be made based on visual observation.

c. Validity

The present spillway structure is not that shown on the bridge drawings. The bridge and abutments appear to correspond to the drawings, but elevations are not to MSL datum.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

The visual inspection made of Allentown Dam revealed that the dam and spillway were in serviceable condition, but that a regular program of inspection and repair is required to maintain its serviceability.

b. Dam

The dam embankment appears to be in a stable condition. The upstream face, retained throughout by a concrete or rendered masonry wall, shows no vertical misalignment and only minor surface cracking and spalling. No surface cracks in the road to suggest movement were noted. The downstream face consists of an assortment of concrete walls, masonry walls and sloped fill, inclined no steeper than 2H:1V. Concrete rendering on the surface of the masonry sections of wall is badly spalled and cracked, and masonry joints are weathered. A part of the concrete wall has been undermined and a 2' x 1' segment has broken away. The sloping fill below the walls is supporting a dense growth of trees, sufficient in size to cause stability problems with their roots. Small areas of rip-rap protection are functioning adequately. Seepage was noted at the downstream toe throughout the visible length, and erosion of fill in this zone has taken place, exposing the footing in places. Estimated total seepage flow was not more than 2 gpm and no artesian-type flow was noted. It appeared that very fine silt was being washed out of the embankment with the seepage, and this requires further investigation. No major misalignment was noted.

c. Appurtenant Structures

1. Spillway

The spillway stop-planks showed signs of leakage around the sides, and through the planks themselves. Some of the planks appeared to be extensively rotted. The timber gates were all in good condition, but the slides and support posts are rotted. The original lakeside walkway has been removed, leaving only the brackets. The concrete frame and raker beams were in satisfactory condition. Debris had lodged on the stop-planks and behind the raker beams, but flow was not unduly restricted. The spillway apron surface was not visible due to the flow of water, but the horizontal alignment was satisfactory and no excessive turbulence to suggest deterioration was found. Undermining at the toe was minimal.

2. Low-Level Outlet

A mill-race, of indeterminate cross-section, feeding the old mill was found at the extreme right of the dam. The upstream end of the race is blocked by an old makeshift timber gate, which is holding back a 5-foot head of water. The blockage appeared to be in danger of collapsing. The race discharges below the mill building, but is not presently operable. It is not known if an operational gate-valve exists within the mill to shut off the flow.

3. Bridge and Piers

The steel and concrete bridge deck is in good condition. Extensive spalling of the concrete abutments has taken place, but the bridge does not appear to be in immediate danger.

d. Reservoir Area

The slopes around the rim of the reservoir are moderately sloped. At the downstream end, residential development has been extensive on both banks. The upstream area is wooded and rural. No indication of instability was apparent. Sedimentation has occurred throughout the reservoir and is reported to be up to the top of the permanent stop-planks.

e. Downstream Channel

The downstream channel is well developed beyond the stilling pool below the apron. The left bank is high and steep with evidence of undermining and instability. There are residential properties at the top of the bank which could be in danger in the event of dam failure. The right bank is 4-6 feet high with a few workshops around the pool. On both sides, bank slopes are about 1 on 1 and there is extensive tree and brush growth. Downstream at Fowlers Bridge Road, the Borough Sewage Treatment Plant is located on low ground on the right bank. Severe damage to this facility could be caused if dam failure were to occur.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Allentown Dam is used to impound water for agricultural irrigation, flood control and recreation activities. The discharge from the lake is over the stop-plank spillway, and is regulated by raising one or more of the eight gates according to the stage. Operation of the gates is in the hands of the District Foreman of District No. 7, Monmouth County, who has been in charge for three years. Operation of the gates requires two or three men. In the event of an emergency, the local inhabitants contact the District foreman through the Allentown Police; the operation team are on 24 hour call, but live several miles from the dam. No formal procedures have been established regarding the number of gates to be raised in order to prevent either flooding the downstream area or overtopping of the dam.

The lake is not lowered on a regular basis.

4.2 Maintenance of the Dam

There is no program of regular inspection and maintenance of the dam and appurtenant structures. Monmouth County has made periodic unrecorded repairs to the dam when such action was needed to protect their road. No Authority has been identified as being responsible for maintaining the dam itself and no recent records of this function have been found.

4.3 Maintenance of Operating Facilities

The Operating Facilities for Allentown Dam consist of the eight timber flood gates and the mill-race. The gates have been recently replaced and are regularly attended to. The mill-race is partially blocked and assumed permanently inoperable.

4.4 Evaluation

It is highly desirable that ownership of Allentown Dam be established, as the essential first stage in initiating a program of regular inspection and maintenance.

The present operational procedures are not considered to be satisfactory. The absence of specific guidelines for gate operation to satisfy upstream and downstream demands is likely to lead to conflict and to a potentially dangerous situation. Similarly, the distance of the operating crew's base from the dam could lead to problems in an emergency situation.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The drainage area above Allentown Dam is a total of 17.4 square miles, comprising a drainage area of 8.8 square miles above Imlaystown Dam upstream, and a local drainage area of 8.6 square miles between Allentown and Imlaystown Dams. A drainage map of the watershed of the dam site is presented on plate 1, Appendix D.

The topography within the basin is moderately sloped. Elevations range from approximately 350 feet above MSL at the east end of the watershed to about 60 feet at the dam site. Land use patterns within the watershed are mostly agricultural, with residential development around the lake.

The evaluation of the hydraulic and hydrologic features of the lake was based on criteria set forth in the Corps Guidelines. and additional guidance provided by the Philadelphia District, Corps of Engineers. The SDF for the dam falls in a range of ½ PMF to PMF. In this case the low end of the range, ½ PMF, is chosen since the factors used to select size and hazard classification are on the low-side of their respective ranges.

The probable maximum flood (PMF) was calculated from the probable maximum precipatation using Hydrometeorological Report No. 33 with standard reduction factors. Due to the presence of Imlaystown Dam upstream, the following method was used to develop the inflow hydrograph for Allentown Dam. The SCS triangular unit hydrograph with the curvilinear transformation was used to develop the inflow hydrograph for Imlaystown Dam. This was then routed downstream to Allentown Dam, taking three intermediate sections and considering channel storage between Imlaystown and Allentown Reservoirs, using HEC1-DB Flood Hydrograph Computer Program.

Initial and infiltration loss rates, were applied to the Probable Maximum Precipitation to obtain rainfall excesses. The rainfall excesses were applied to the unit hydrograph to obtain the PMF and various ratios of PMF utilizing program HEC1-DB.

The SDF peak inflow calculated for Allentown Dam is 17,815 cfs. This value is derived from the 1/2 PMF, and results in overtopping of the dam.

The stage-outflow relation for the spillway was determined from the geometry of the spillway and dam, and is shown in the Hydrologic Computations (Appendix D).

The reservoir stage-storage relationship was computed directly by the conic method, utilzing the HEC1-DB program. The conic method assumes that the reservoir capacity resembles a series of vertically stacked cones. The reservoir surface areas at various elevations were measured by planimeters from U.S.G.S. Quadrangle topographic maps. Reservoir storage capacity included surcharge levels exceeding the top of the dam, and the spillway rating curve was based on the assumption that the dam remains intact during routing.

A breach analysis indicated that the hazard potential for loss of life downstream, due to dam failure from overtopping, is not significantly greater than that which exists without failure. However, at lower flow (say 10% of the PMF), there will be significant rise (2.6 feet) in water surface elevation at the downstream reach due to dam failure.

Because no low-level outlet exists, no drawdown calculations have been made.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. However, it is known that the bridge and spillway were washed out in 1920, and that the dam was overtopped in 1947. Part of the road to right of the spillway was washed out at that time, but it is not known or recorded what other damage was caused by overtopping.

c. Visual Observation

The valley below the dam is partially developed with residential properties on the left bank and a Sewage Treatment Plant downstream on the right bank.

Stream banks are lightly wooded. Banks of the reservoir are moderately sloped and stable, and have residential development at the downstream end. Land use in the drainage basin is agricultural and lightly wooded.

d. Overtopping Potential

A storm of magnitude equivalent to the SDF would cause overtopping of the dam to a height of 9.1 feet. Computations indicate that the dam can pass approximately 3% of the PMF without overtopping the dam crest. Since one half the PMF is the Spillway Design Flood (SDF) for this dam, and since the hazard potential for loss of life downstream due to dam failure caused by overtopping is not greater than that which exists without failure, the spillway capacity for Allentown Dam is assessed as "inadequate."

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The observations made during the inspection do not give cause for undue concern. The stability of the dam embankments appears to be satisfactory, although surface weathering is in an advanced stage. The spillway stop-planks were found to be in poor condition, and present a potential flooding hazard. The state of the mill-race is not satisfactory and should be investigated further. The excessive siltation of the reservoir has greatly reduced its capacity, but the banks are stable. The occupation of the downstream area confirms the "high" hazard potential rating. The lack of any operable low-level outlet or emergency gate adversely effects the operability of the dam.

b. Design and Construction Data

No design computations were uncovered during the report preparation phase. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction are available for use in the stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam. Part of the road was washed out in 1947 and the bridge and spillway were washed out in 1920. In neither case was total breach or instability caused.

d. Post-Construction Changes

No changes significant to the stability of the dam are on record.

e. Static Stability

A static stability analysis was not performed for Allentown Dam because the lack of data on which to base assumptions of material properties and embankment cross-sections might produce misleading results.

f. Seismic Stability

The dam is located in Seismic Zone 1, as defined in Recommended Guidelines for Safety Inspection of Dams, prepared by the Corps

of Engineers. In general, projects located in Seismic Zones 0, 1 and 2 may be assumed to present no hazard from earthquake, provided the static stability conditions are satisfactory and conventional safety margins exist. Since static stability safety factors have not been confirmed, it cannot be stated that seismic stability is satisfactory. When the recommended static stability analysis has been made, seismic stability can be re-evaluated.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. Safety

The dam has been inspected visually and a review has been made of the available engineering data. This assessment is subject to the limitations inherent in the visual inspection procedures stipulated by the Corps of Engineers for a Phase I report.

The safety of Allentown Dam is in question because the dam does not have adequate spillway capacity to pass one-half of the PMF without overtopping. Overtopping of the dam carries with it the danger of possible progressive failure of the dam or spillway. The dam's present spillway capacity can pass only about 3% of the PMF, and is "inadequate."

No definitive statement pertaining to the safety of the embankment can be made without acquisition of embankment and foundation material engineering properties. The possibility of failure may exist in the event of failure of Imlaystown Dam upstream.

b. Adequacy of Information

The information uncovered was adequate to perform hydrologic computations, although the depth of the lake is not known. The data was insufficient to perform even an approximate computation of the dam's stability. An assessment of the dam could be made by visual observation only.

c. Urgency of Studies

A more precise hydrologic and hydraulic analysis of the dam should be conducted within six months, to determine the need and type of mitigating measures necessary. If required, conduct a study of the means of increasing spillway discharge capacity and develop alternative schemes for construction. This should include the installation of headwater and tailwater gages, and determination of the ability of the dam to withstand overtopping.

Borings should be made and logged according to the Unified Soil Classification system by qualified personnel. This information should be obtained within six months, and should be evaluated immediately upon acquisition to perform stability analyses in accordance with Chapter 4.4 of the Corps Guidelines.

Conduct a complete topographic survey of the dam and surrounding area, in order to develop a detailed plan and several cross-sections

of the dam. Annotate and update the existing drawings, and form a coherent as-built set within six months.

7.2 Remedial Measures

a. Alternatives for Increasing Spillway Capacity

Alternatives for increasing spillway capacity are as follows:

1. Increase the dam and bridge height, thus permitting a higher discharge to pass over the spillway and reducing the possibility of overtopping.

2. Lower the weir crest elevation.

3. Widen the weir structure.

4. A combination of any of the above alternatives.

b. Other Remedial Measures

1. Replace the old timber stop-planks with steel or concrete planks. Replace the timber slides and supports. This work to be completed in six months.

2. Provide concrete underpinning at the toe of the retaining walls where undermining has occurred. This work to be commenced within six months.

3. The embankment material that has been lost by erosion from the downstream toe of the retaining walls should be replaced. This work should be undertaken within six months.

4. Block off the mill-race by filling with concrete within six months.

5. A safe means of lowering the lake should be provided. This work should commence within 12 months.

6. Repair spalled and cracked concrete and concrete facing, repoint all masonry as necessary within 12 months.

7. All brush and trees should be removed from the downstream slopes to avoid problems which may develop from their roots. The embankment should then be seeded to develop a growth of grass for surface erosion protection. This program should be started within 12 months.

c. Recommendations

The following additional action is recommended.

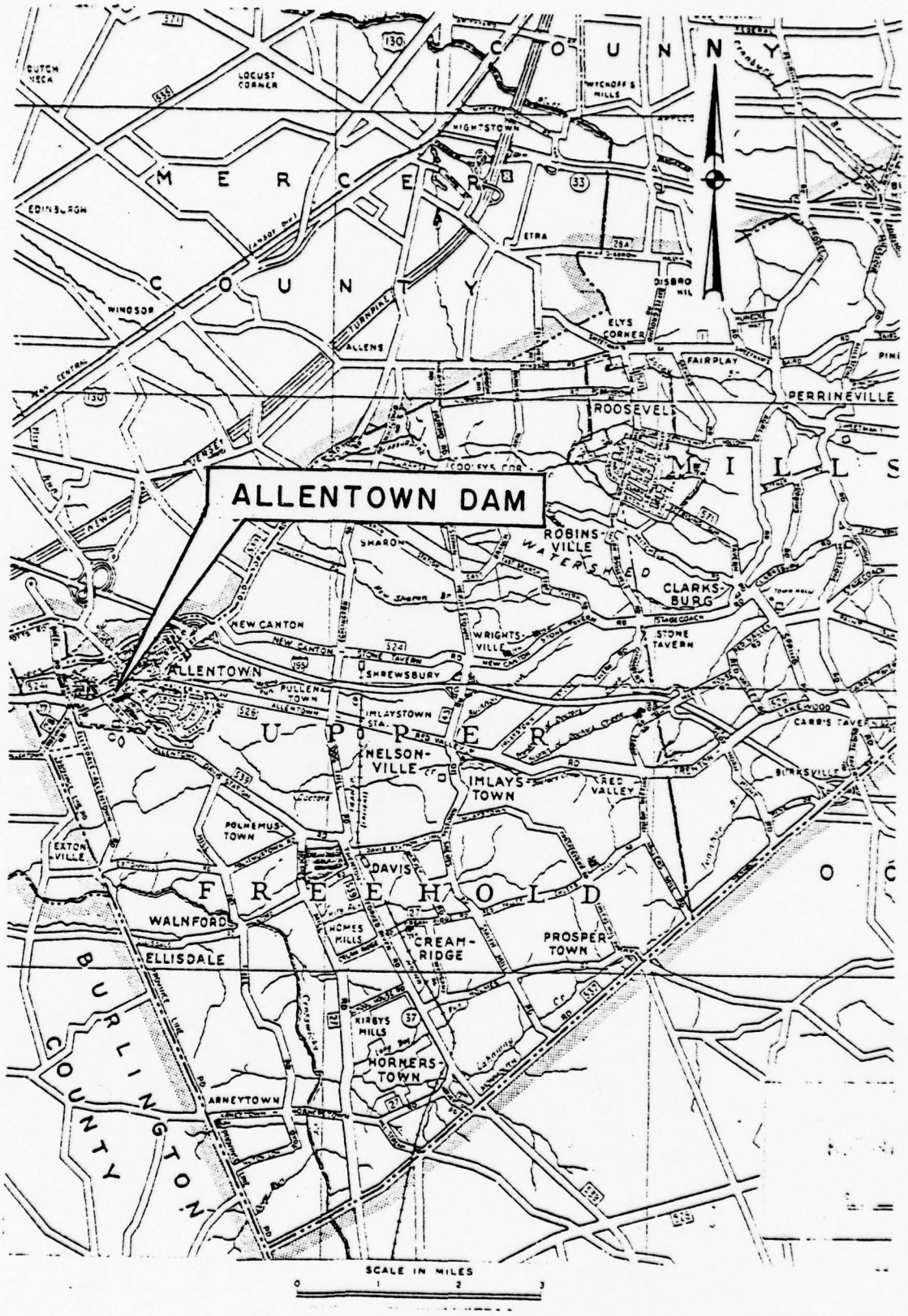
1. Establish ownership of the dam immediately.

2. Establish a flood warning system for the downstream communities within three months.

3. Review the present operational procedures, and develop specific guidelines on gate operation and emergency procedures. The guidelines, to be agreed upon by upstream and downstream users and by all parties concerned, should be implemented within three months.

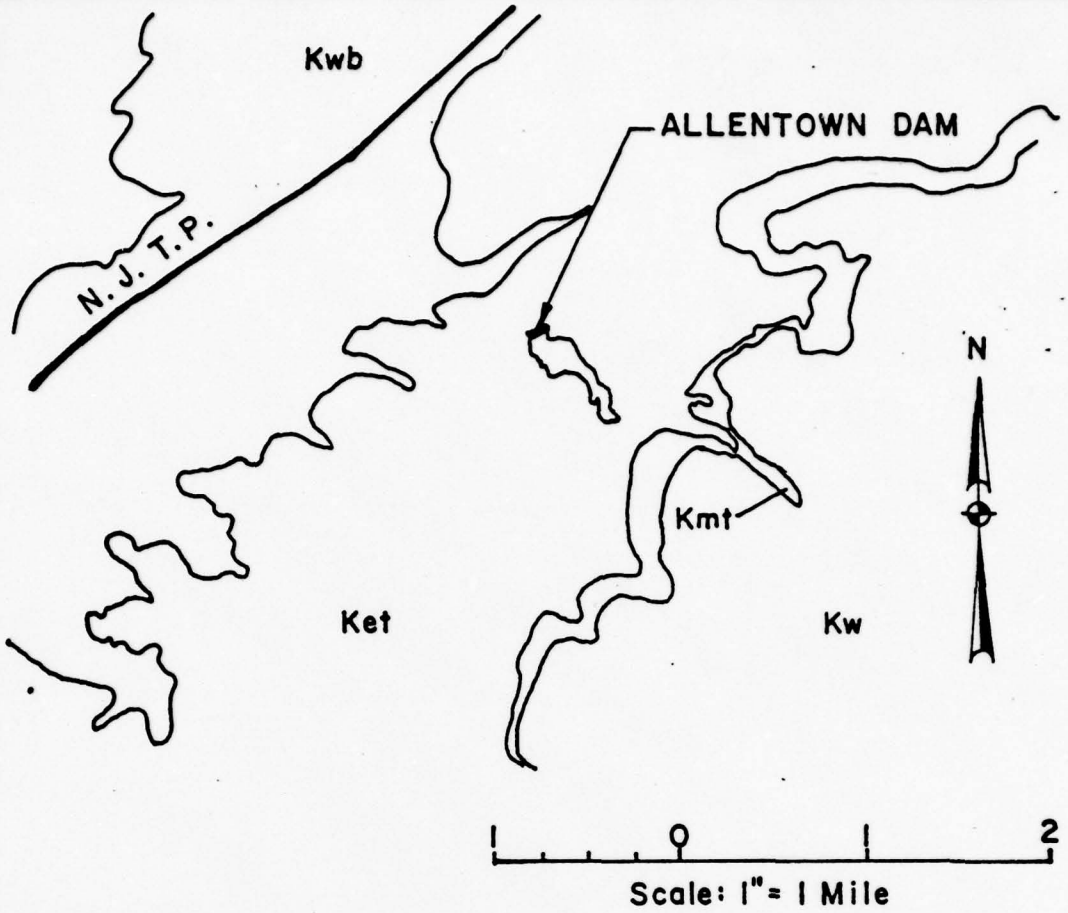
d. O & M Procedures

A formalized program of annual inspection of the dam by an experienced party should be initiated, utilizing the standard visual check list in this report. Headwater and tailwater gages should be installed in the dam, and read out during severe rain storms and at routine operating and maintenance visits to the dam. A permanent log should be kept of all maintenance and operating events of the dam, the lake and outlet passages. Movement and settlement of the embankment should be monitored regularly by means of surveying monuments, and seepage flows recorded.



VICINITY MAP

PLATE 1



LEGEND

CRETACEOUS

Ket Englishtown Sand
White and Yellow Sand with Mica and Glauconite and Localthin Layers of Clay.

Kwb Woodbury Clay
Black to Dove-Colored Clay, usually Nonglauconite.

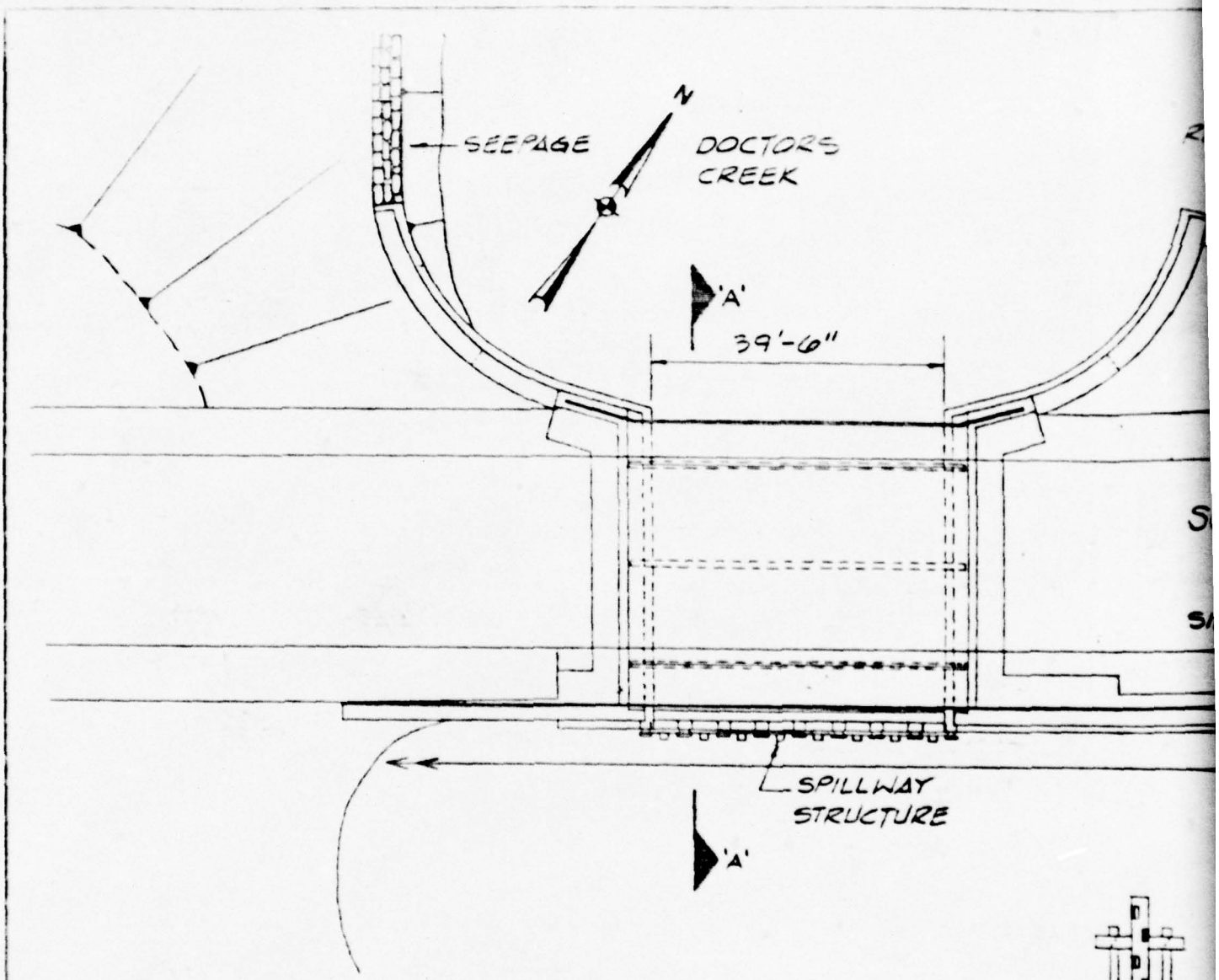
Kmt Marshalltown Formation
Black Sandy Clay to Clayey Glauconitic Marl.

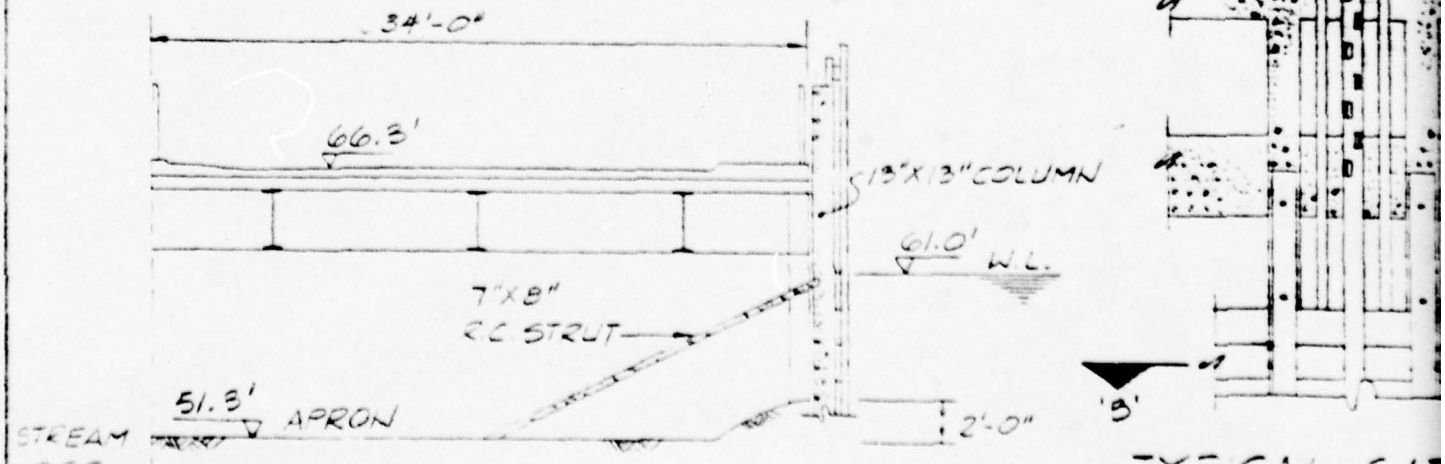
Kw W Wenonath Sand
Fine Micaceous Sand.

— Contact

GEOLOGIC MAP
ALLENTOWN DAM

PLATE 2

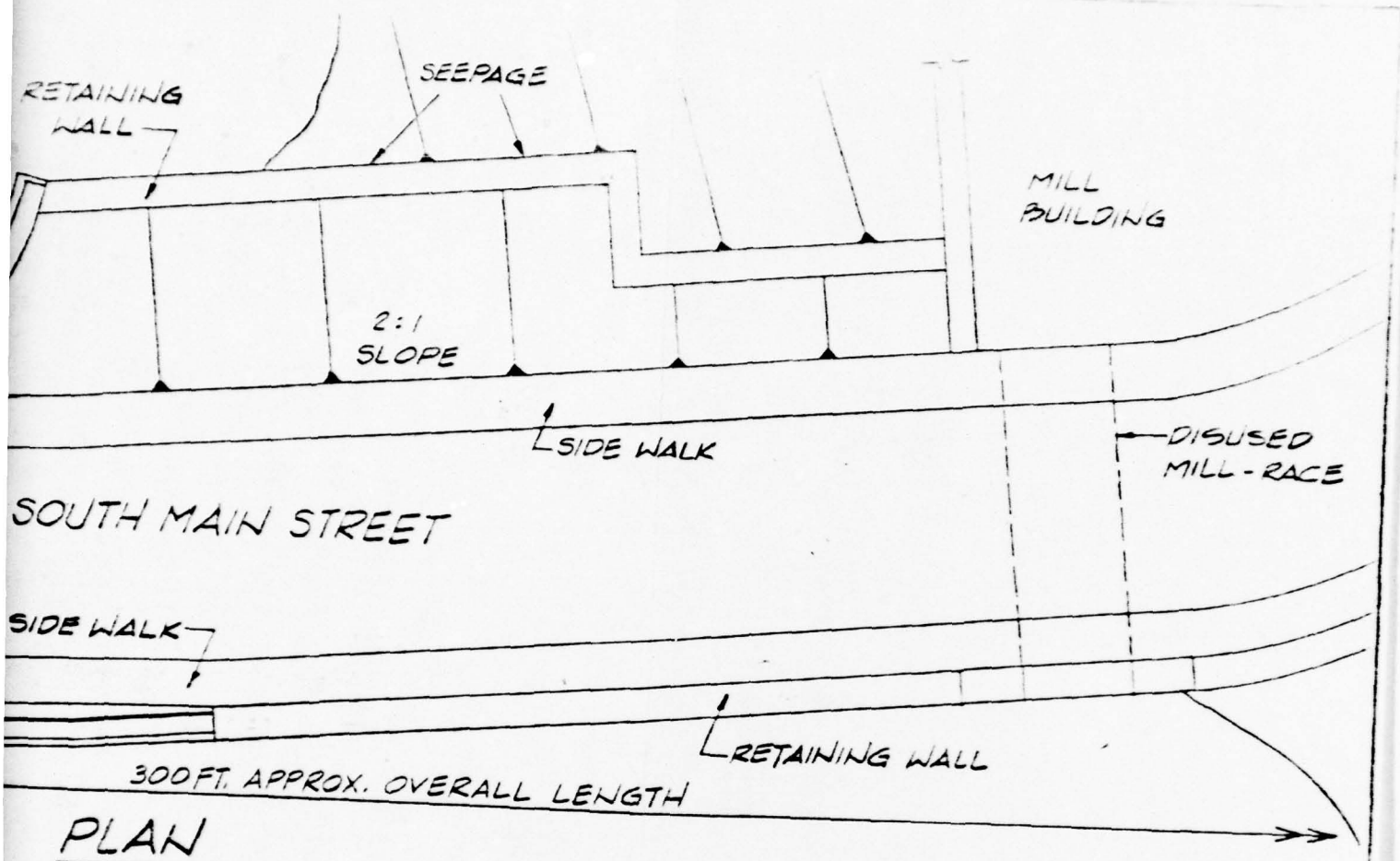




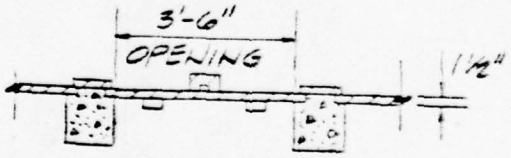
SECTION 'A'-'A'

TYPICAL GAT
ELEVATION

1



PLAN



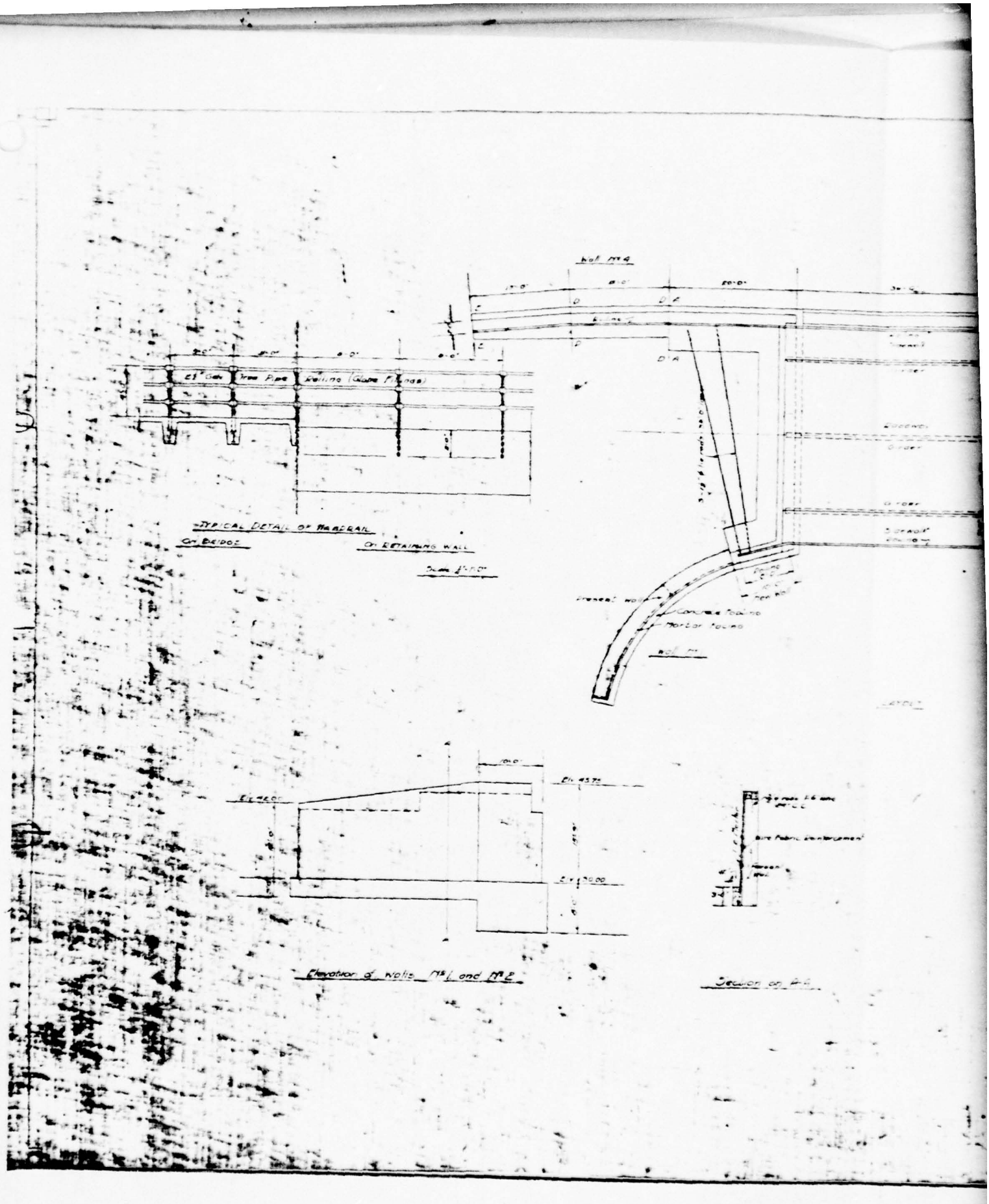
SECTION 'B'-'B'

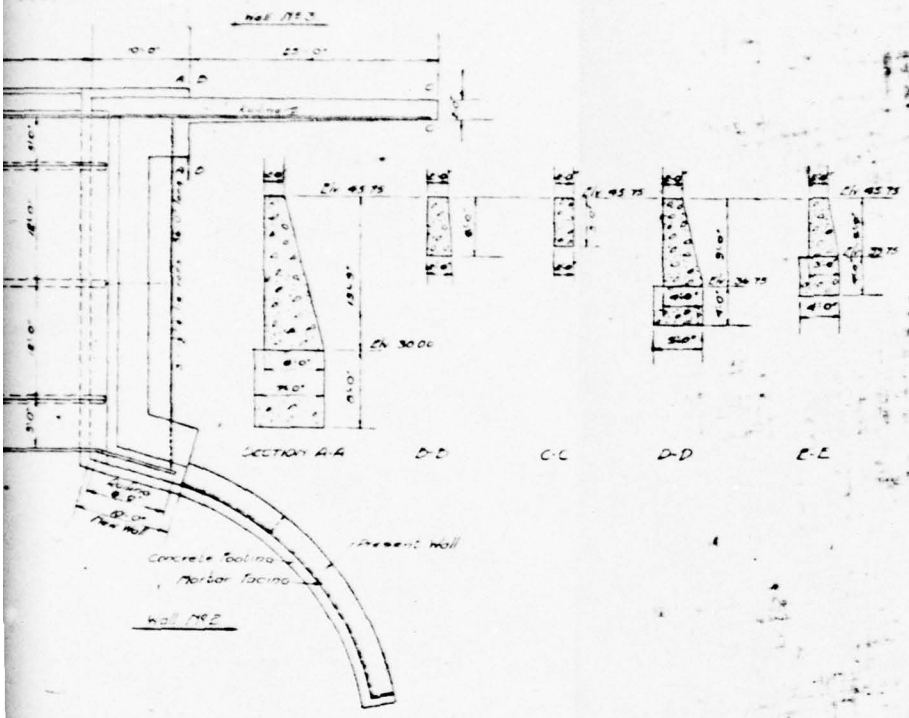
'B'

ALLENTOWN DAM

FROM FIELD NOTES (NOT TO SCALE)
MAY 1979

PLATE 3


Wall No 4
TYPICAL DETAIL OF HANDRAIL
On BRIDGE
On RETAINING WALL
Elevation of Walls No 1 and No 2
Section on A-A



MONMOUTH COUNTY, N.J.

GEORGE D. COOPER, COUNTY ENGINEER

ALLENTOWN BRIDGE

No U-12.

SCALE 3/4" = 1'-0"
DATE 9/10/20

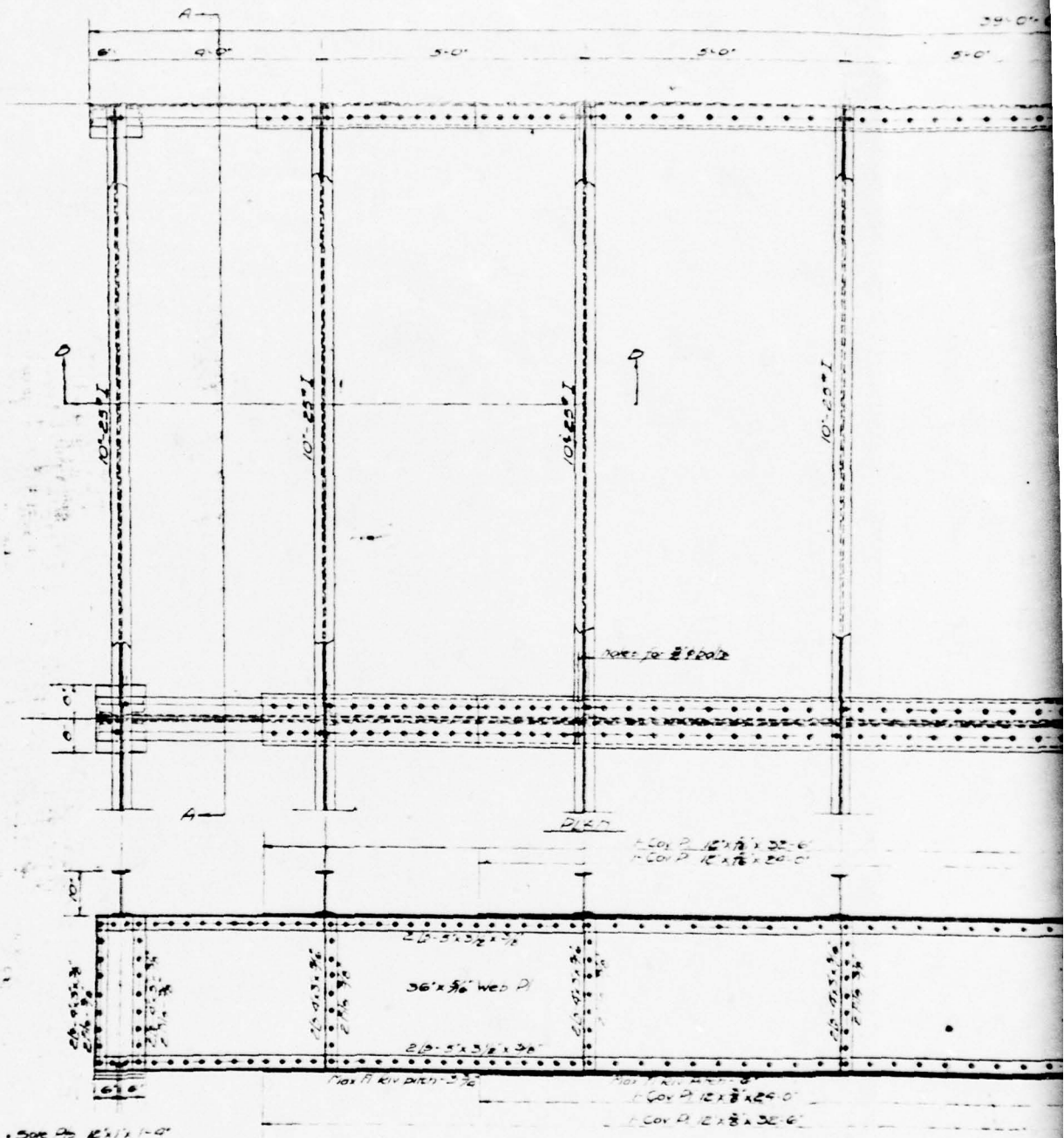
DRAWN BY J.F.D.
TRACED BY L.W.L.

SHEET No 1

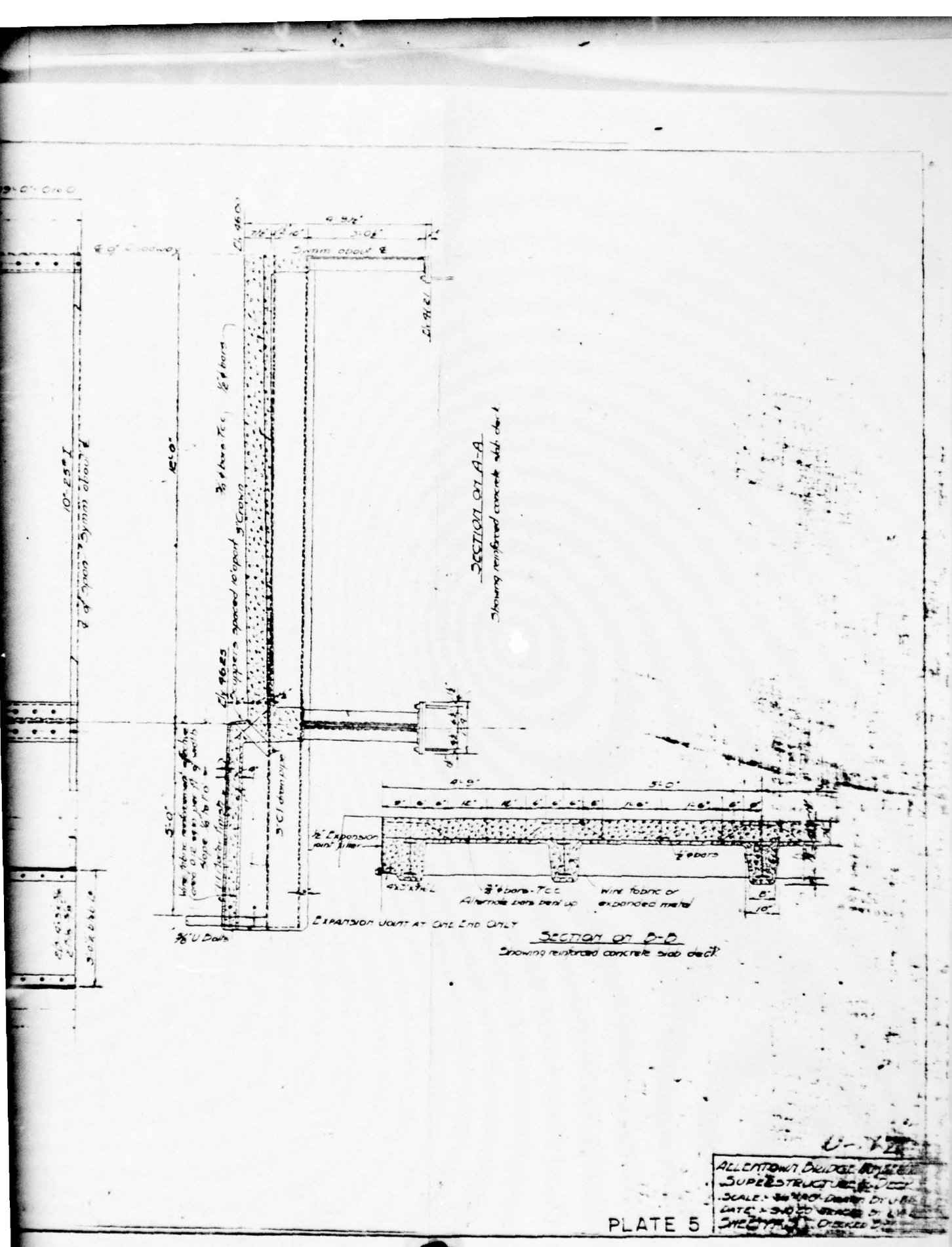
PLATE 4

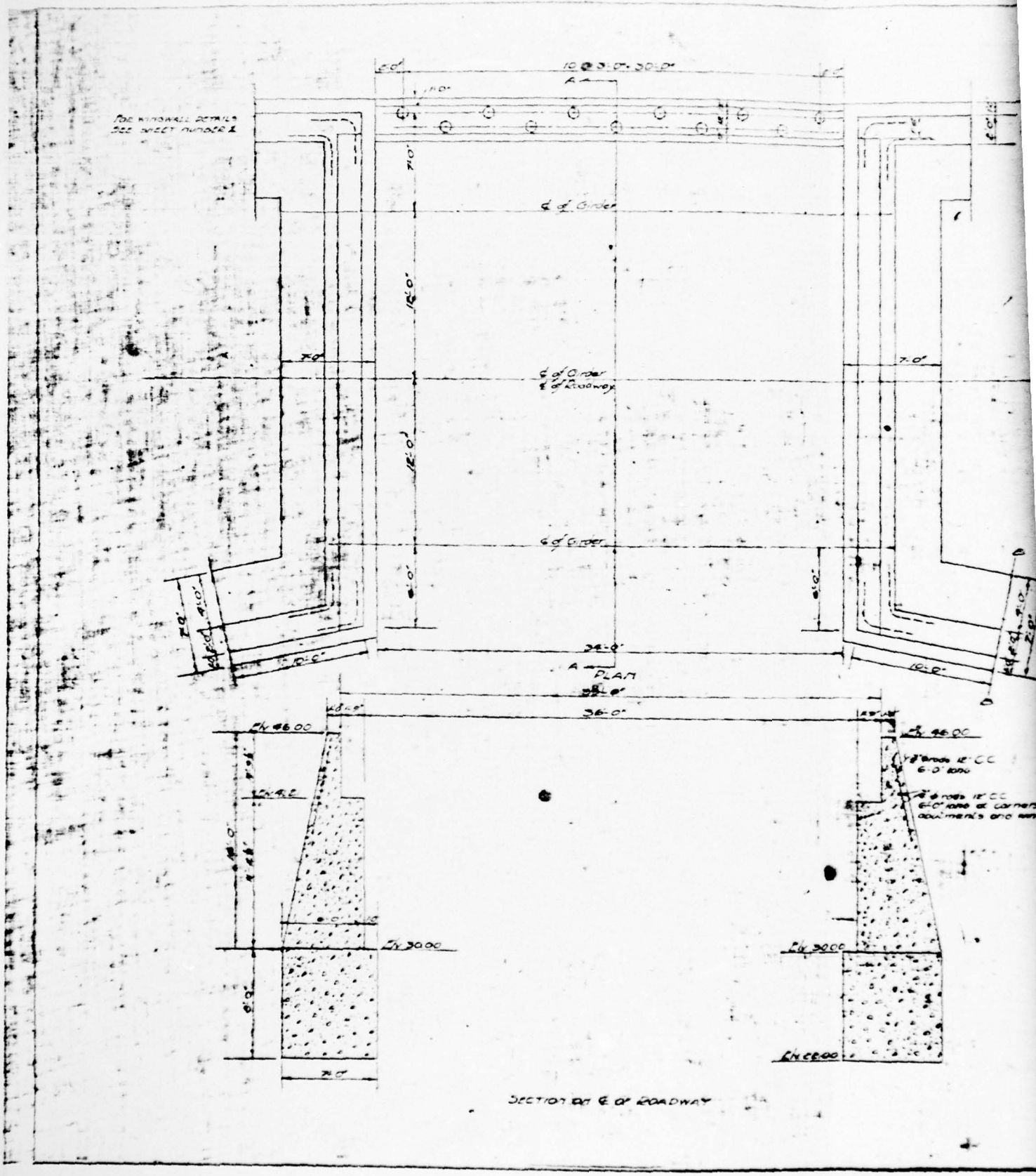
1

2



• Side Pls 12"x1"x1'-0"
End Pls 12"x1"x1'-0"
Anchor Bolts 1"ø x 1'-6"
Slotted holes at one end


Section on A-A
Showing reinforced concrete slab deck
Section on B-B
Showing reinforced concrete slab deck
Expansion joint at one end only
½" Expansion joint filler
Wire fabric or expanded metal
Alternate bars bent up
PLATE 5


10 @ 3'-0" = 30'-0"
SEE WINGWALL DETAILS SEE SHEET NUMBER 8
℄ of Girder
℄ of Girder ℄ of Roadway
36'-0"
PLAN
EL 46.00
EL 43.2
EL 39.00
EL 36.00
SECTION ON ℄ OF ROADWAY

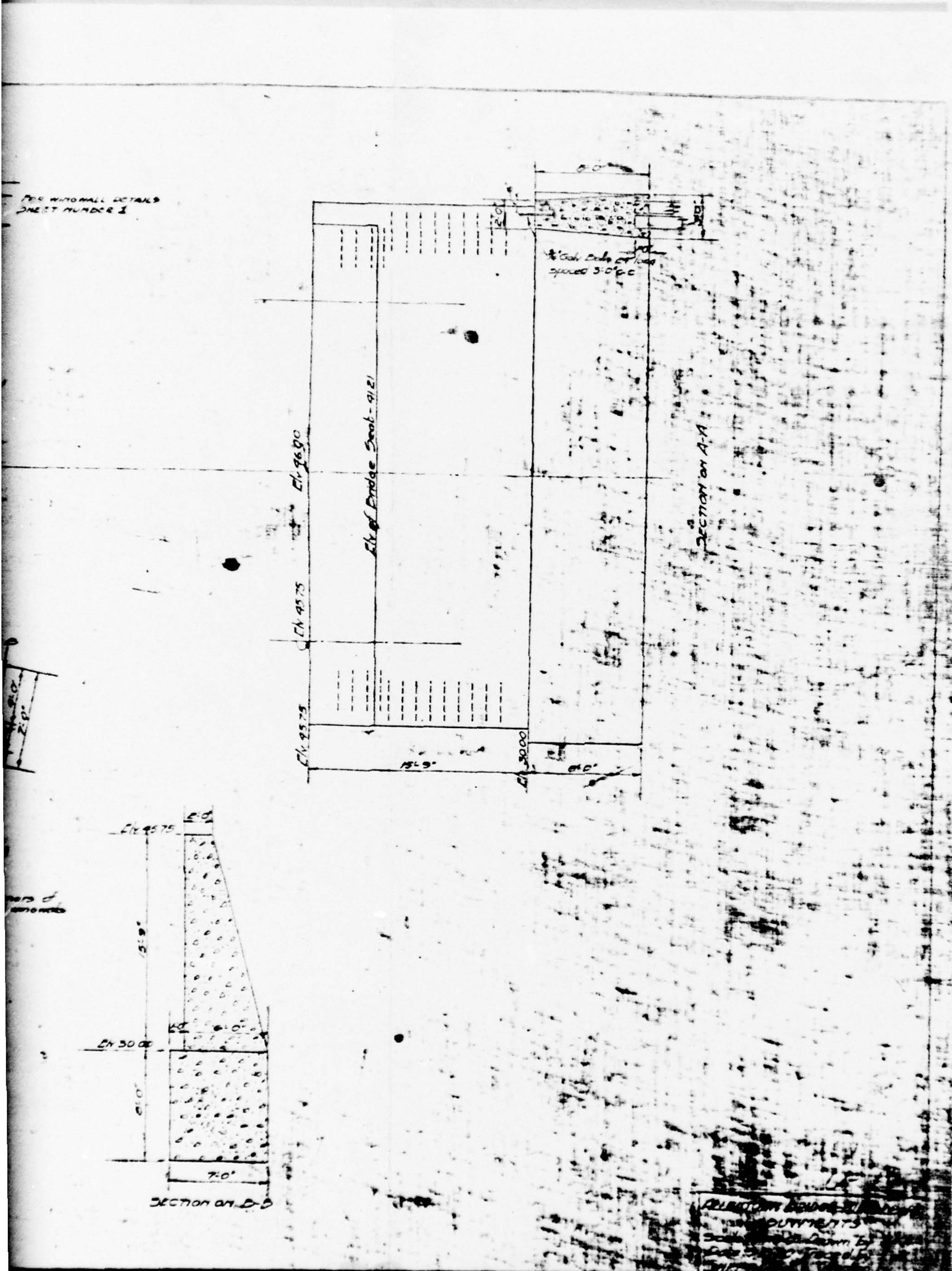

SECTION ON A-A
EL 96.90
EL 95.75
℄ of Bridge Seat - 91.21
EL 30.00
15'-9"
8'-0"
7'-0"
SECTION ON B-B

PLATE 6

APPENDIX A

CHECK LIST - VISUAL OBSERVATIONS

CHECK LIST - ENGINEERING, CONSTRUCTION, MAINTENANCE DATA

CHECK LIST
VISUAL INSPECTION

PHASE I

Name of Dam Allentown Dam County Monmouth State New Jersey Coordinators NJDEP

Date(s) Inspection May 1, 1979 Weather Sunny Temperature 60°
June 1, 1979

Pool elevation at Time of Inspection 61.0' M.S.L. Tailwater at time of Inspection 50.5' M.S.L.

Inspection Personnel:

May 1, 1979

Seymour Roth
Henry King
Chuck Chin
Tom Lynch

June 1, 1979

Rhon Ernest-Jones

Owner/Representative

None attended

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SURFACE CRACKS	No cracking was noted in the road surface. Concrete facing on d/s masonry retaining walls has cracked off up to 2' above water level generally, and higher in places. Minor spalling and cracking of concrete facing on upstream retaining wall. Concrete support for spillway structure is badly cracked.	Remove cracked or loose facing, clean and reface with gunite.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	Part of the concrete retaining wall on the right bank has cracked away at the toe. 2' x 1' segment is missing.	Fill the hole with concrete.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Upstream face is retained for its full length by a masonry/concrete wall. Downstream face is retained for most of its length by walls, including an arched section on each side of the spillway. Part of the downstream face is free standing fill sloped at 2H:1V. Local erosion of fill under spread footing of retaining walls downstream.	The small areas of eroded fill should be replaced with concrete.
VERTICAL & HORIZONTAL ALIGNMENT OF THE CREST	No misalignment or undue settlement noted. The dam is slightly arched towards the reservoir.	
RIPRAP FAILURES	None noted in the small areas of downstream bank protection.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
UTILITIES		
	The following utilities and fittings are carried across the dam: a. Water main b. Gas main c. Overhead cables d. Traffic barrier and handrailing.	Contributes to "high" hazard rating of dam.
JUNCTION OF EMBANKMENT AND ABTUMENT, SPILLWAY AND DAM		
	No differential settlement noted.	
ANY NOTICEABLE SEEPAGE		
	Seepage was noted at the toe of both downstream retaining walls over the full length visible. Seepage was slightly discolored by suspended silt. Estimated total seepage rate was 2 gpm.	Monitor seepage periodically.
STAFF GAGE AND RECORDER		
	None.	
DRAINS		
	Drainage outfalls on the upstream right and downstream left retaining walls.	Assumed to be stormwater drains.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SPILLWAY STRUCTURE		
	The spillway structure consists of a vertical concrete frame of 8 portals, flush with the upstream retaining wall. The frame is braced with raker beams which terminate at the apron. Permanent timber stop-planks fit in slides on each portal up to elevation +49'. The concrete structure is in good condition but the planks are deteriorated and leakage was noted between them.	Replace timber stop-planks with concrete or steel gates.
APPROACH CHANNEL		
	None.	
DISCHARGE CHANNEL		
	The discharge channel is a horizontal concrete apron confined by the bridge abutment walls. The apron appears to be sound, with minimal lateral erosion or undermining of the toe. A tree trunk was jammed in the raker beams at the time of the inspection.	Clear apron of debris.
BRIDGE AND PIERS		
	The steel and concrete bridge over the spillway apron was in good condition. The concrete facing on the masonry abutments has spalled extensively around the bridge deck footings.	
GATES & OPERATION EQUIPMENT		
	The upper 2 feet of stop-planks in each of the portals are designed to be moveable, and are fitted with timber lifting frames for manual operation. The gates have been recently renewed, but the slides and props are deteriorated. Only seven of the eight gates are operational. The two right-hand gates were propped open at the time of inspection, held by pinch-bars.	Replace timber slides and provide mechanical device for operation.

OUTLET WORKS (MILL-RACE)

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CRACKING & SPALLING OF CONCRETE SURFACES IN STILLING BASIN	N.A.	
INTAKE STRUCTURE	Intake to the mill-race outlet is blocked by an inadequate makeshift timber barrage, in imminent danger of collapse. Intake is on the extreme right of the dam.	
OUTLET STRUCTURE	Mill-race outlet passes under the road, through the mill and discharges downstream. Existence of a sluice gate is not known. Mill-race is reported to be heavily silted up.	Fill outlet with concrete.
OUTLET FACILITIES	None.	
EMERGENCY GATE	None.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
MONUMENTATION/SURVEYS	U.S.G.S. benchmark reported to be set in sidewalk on dam, but was not found during inspection.	Chart location of benchmark on plan.
OBSERVATION WELLS	On left side of spillway, attached to wall. Not operational.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHERS	None.	Install head-water and tail-water gages.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
SLOPES	Mild slopes all around reservoir. Banks are lined with deciduous trees and grass, with several residential properties. No sign of instability.	
SEDIMENTATION	Sedimentation is visible in the form of severe aquatic growth in the shallower parts of the reservoir. Also reported to be near the top of non-moveable part of gates.	
USE	Recreation, irrigation storage, flood control.	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS AND RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Downstream channel is well defined. Left bank is high and steep. Right bank about 4-6 feet high. Channel bottom is smooth and about 30-35 feet wide.	
SLOPES	Side slopes of channel about 1:1. Well developed growth of trees and vegetation.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	On left bank there are homes on high ground immediately d/s of dam. Some damage to property possible due to bank erosion if dam fails. Further d/s is a housing development on high ground at Sansburg St. On left bank of stream (10-15 houses) and garden apartments also on high ground (40-50) units. These are in no danger.	
SEWAGE TREATMENT PLANT	Downstream at Fowler's Bridge Road, the Borough Sewage Treatment Plant is located on low ground on right bank, severe damage to this facility could occur if hypothetical dam failure were to occur.	Contributes to "high" hazard potential due to sewerage treatment plant downstream.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	No full plan. Bridge structure only.
REGIONAL VICINITY MAP	U.S.G.S. Quadrangle sheets for Allentown & Roosevelt.
CONSTRUCTION HISTORY	Gates and New Bridge construction in 1921 following dam failure. Gate stems repaired 1972.
TYPICAL SECTIONS OF DAM	None.
HYDROLOGIC/HYDRAULIC DATA	None.
OUTLETS - PLAN	None available.
- DETAILS	None available.
- CONSTRAINTS	None available.
- DISCHARGE RATINGS	None available.
RAINFALL/RESERVOIR RECORDS	None available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	U.S.G.S. Quadrangle sheet overlay. Rutgers report for Monmouth County
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	1972 - Monmouth County - cursory only.
BORROW SOURCES	Not known.
SPILLWAY PLAN - SECTIONS	Not available.
- DETAILS	Not available.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
(continued)

ITEM	REMARKS
OPERATING EQUIPMENT PLANS AND DETAILS	None available.
MONITORING SYSTEMS	None.
MODIFICATIONS	Plans for rebuilding of spillway and bridge, 1920.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	See surveys.
PRIOR ACCIDENTS OF FAILURE OF DAM - DESCRIPTION	On microfiche - Dam and Bridge washed out in 1920.
- REPORTS	Road washed out in 1947. Doria storm, 1971, caused d/s bank erosion, damaging a house and garage.
MAINTENANCE OPERATION RECORDS	None.

APPENDIX B

PHOTOGRAPHS

(Taken on May 1 and June 1, 1979)

Photo No. 1 - Overall view of dam from upstream. The spillway and bridge structure are in the foreground. Note the spalled concrete at the water surface and the deteriorated timber gate supports.

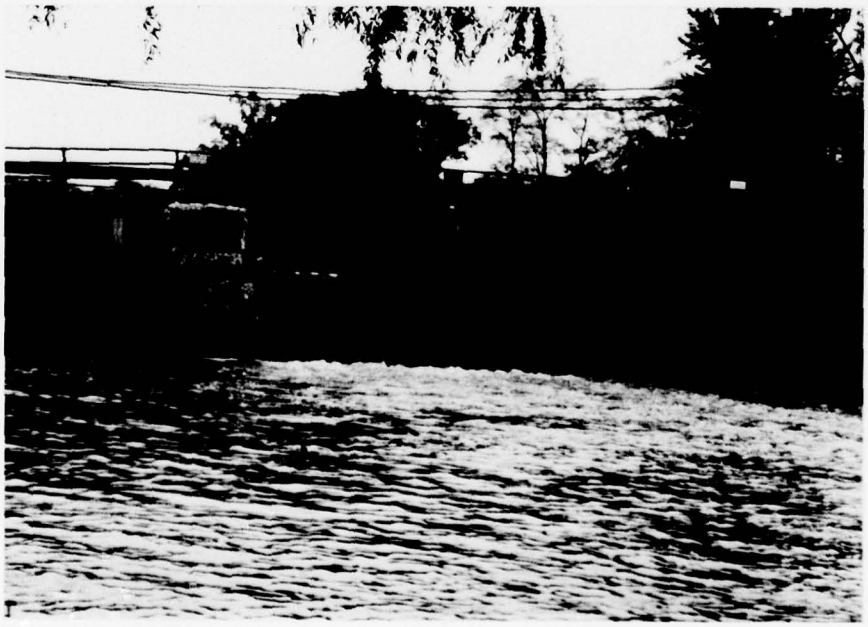


Photo No. 2 - View of spillway, apron and bridge from downstream. Leakage through stop-planks is extensive and concrete wall facing is spalled.

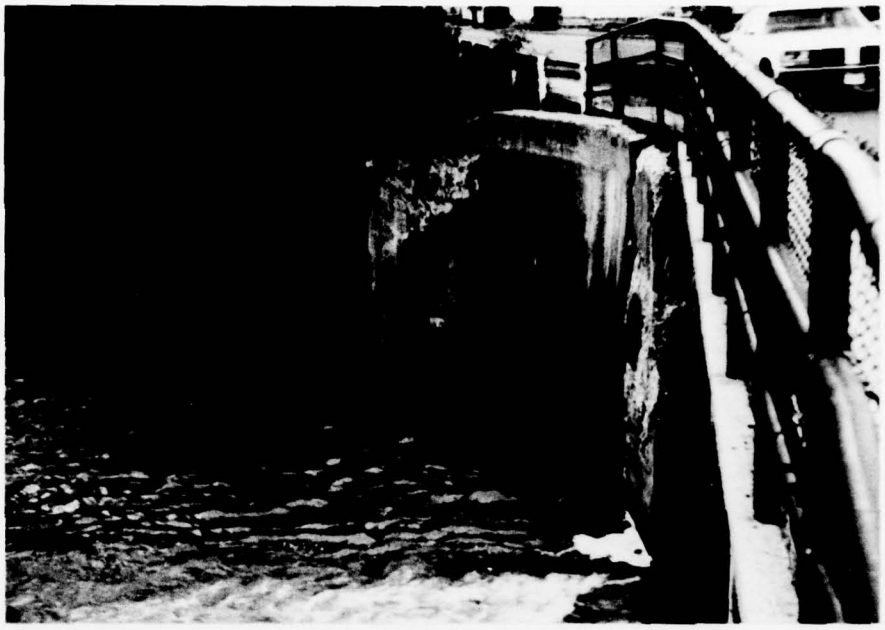


Photo No. 3 - Detail or right downstream retaining wall. Note the deteriorated concrete on the bridge abutment and retaining wall.

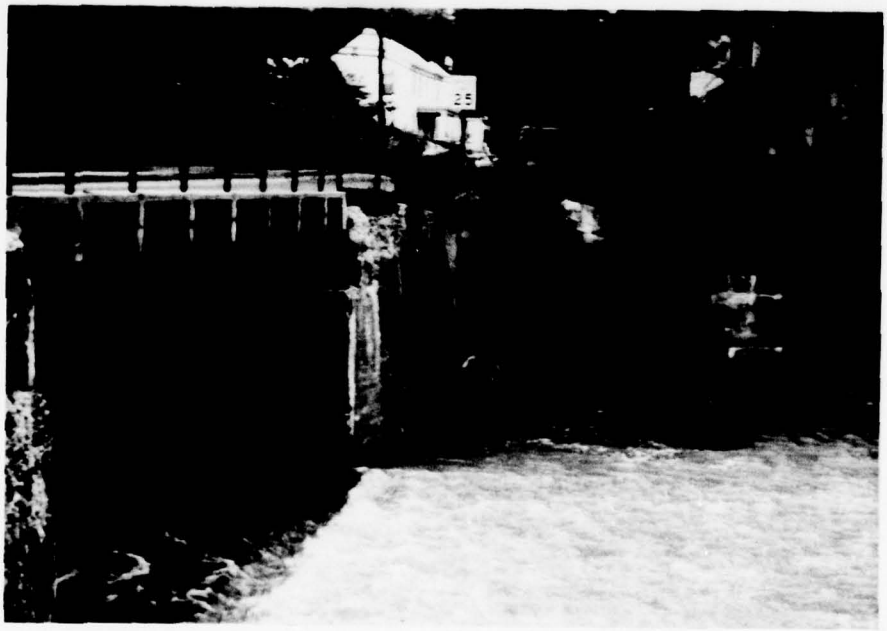


Photo No. 4 - Detail of left downstream retaining wall.

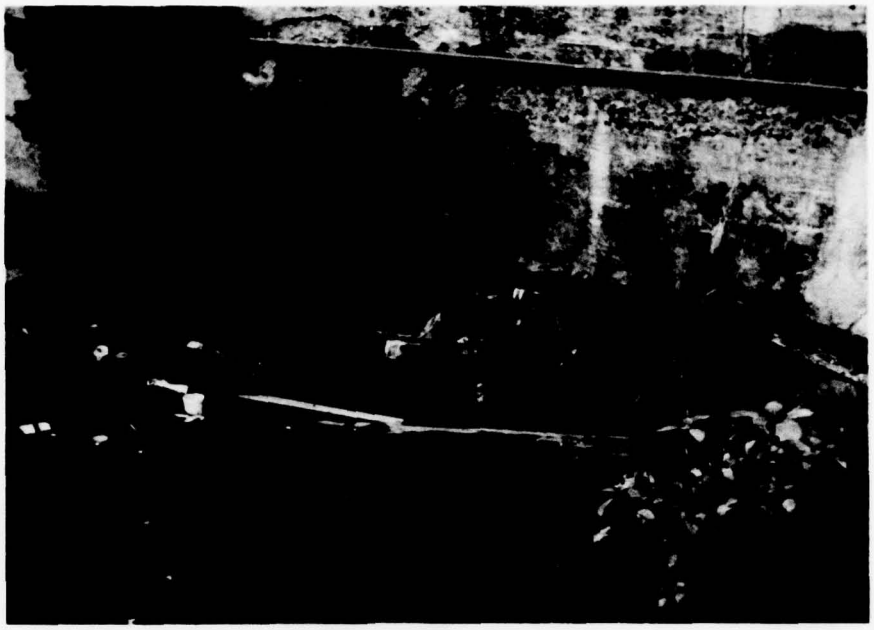


Photo No. 5 - Detail showing the makeshift blockage of the mill-race intake.

Photo No. 6 - View of mill-race outlet and right embankment face.

Photo No. 7 - Detail of support device for holding the timber gates open.

Photo No. 8 - Detail of open timber gate from above.

Photo No. 9 - Detail showing spalled concrete on bridge abutment. Rebar is exposed in concrete support of spillway structure.

Photo No. 10 - View of seepage at the toe of the right downstream retaining wall.

Photo No. 11 - View of the reservoir looking upstream from the bridge. Note moderate slopes and weed growth around rim.

Photo No. 12 - View of downstream channel - Doctors Creek. The channel is wide at the spillway and mill-race outlet and narrows down within 150 feet.

APPENDIX C

SUMMARY OF ENGINEERING DATA

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

Name of Dam: Allentown Dam

Drainage Area Characteristics: Mainly agricultural, lightly wooded, residential near dam.

Elevation Top Normal Pool (Storage Capacity): 61' MSL (341 Acre-feet)

Elevation Top Flood Control Pool (Storage Capacity): N/A

Elevation Maximum Design Pool: (SDF) 75.3' MSL (864 acre-feet)

Elevation Top Dam: 66.3' MSL (496 acre-feet)

SPILLWAY CREST

a. Elevation 61 feet MSL

b. Type Stop-plank and concrete apron.

c. Width 2"

d. Length 17.33' (net)

e. Location Spillover Left side of dam.

f. No. and Type of Gates Eight manually operated timber gates, each 3'6" wide x 2' high.

OUTLET WORK

a. Type Disused Mill-race.

b. Location Right side of dam.

c. Entrance Inverts Not known.

d. Exit Inverts Not known.

e. Emergency Draindown Facilities None.

HYDROMETEOROLOGICAL GAGES

a. Type None.

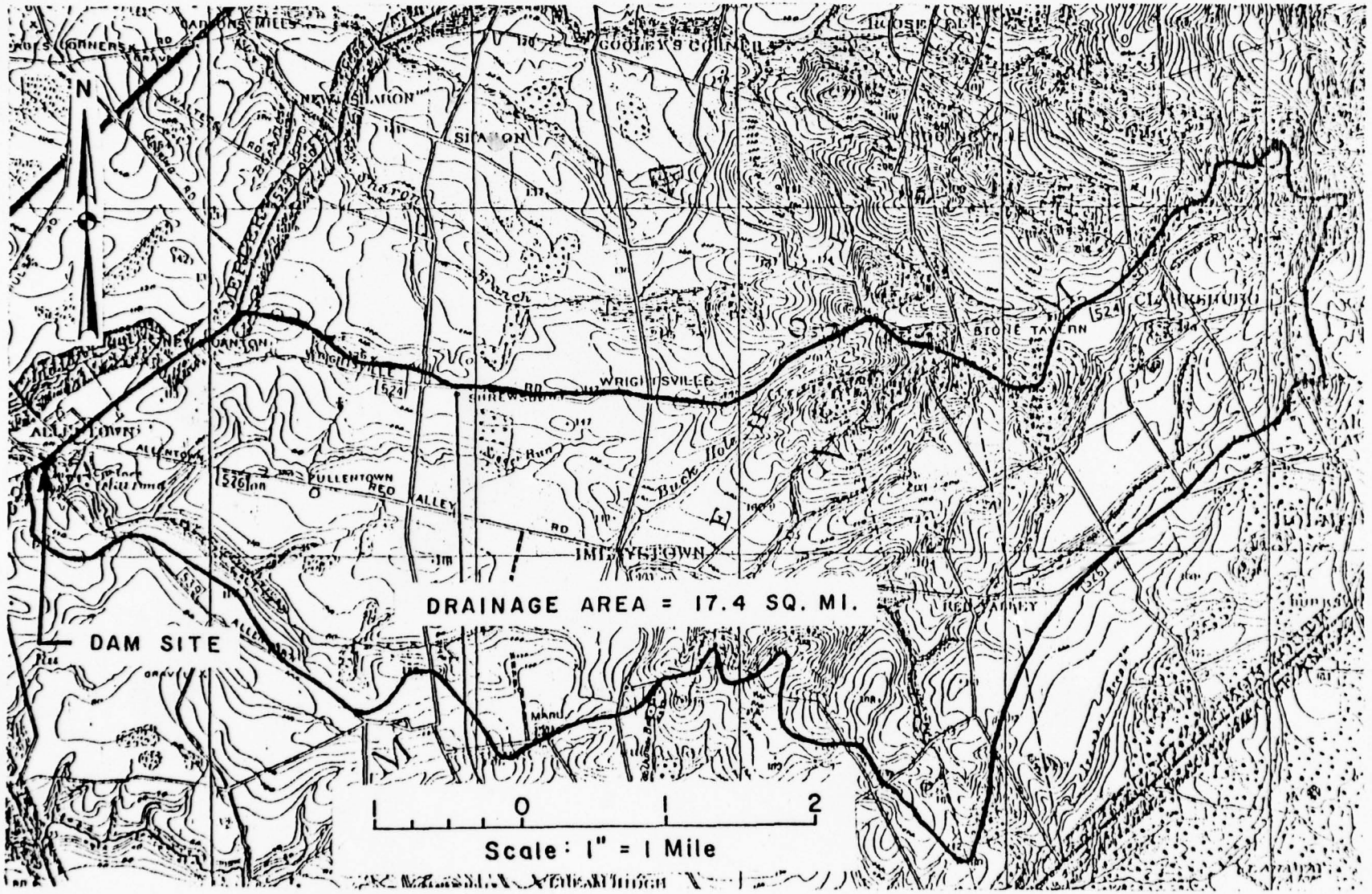
b. Location None.

c. Records None.

MAXIMUM NON-DAMAGING DISCHARGE 751 cfs

APPENDIX D

HYDROLOGIC COMPUTATIONS



ALLENTOWN DAM
DRAINAGE BASIN

Size Classification

Surface Area of impoundment = 25.6 Ac
Depth of Lake = 10' (est. mean)

Classification of Dam = Small

S.D.F for Small Dam, High Haz and

½ PMF to PMF

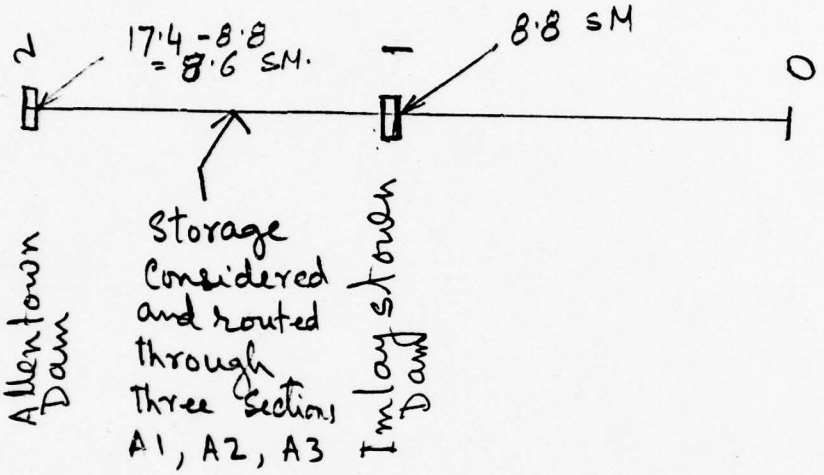
Hydrologic Analysis

Inflow hydrograph at Allentown Dam was determined using HEC 1 DB Computer program.

The system used to develop the inflow was shown in the next page.

The outflow was determined using routing criteria

ALLENTOWN DAM (N.J 00308)



(A) 01 → SCS triangular unit Hydrograph with curvilinear transformation to develop the inflow Hydrograph

(B) Route H.G neglecting attenuation due to Reservoir but consider attenuation in channel.

(C) 12 - SCS unit HG to develop the inflow from the intermediate D.A.

(D) Combine H G.

(E) Routed through Allentown Res.

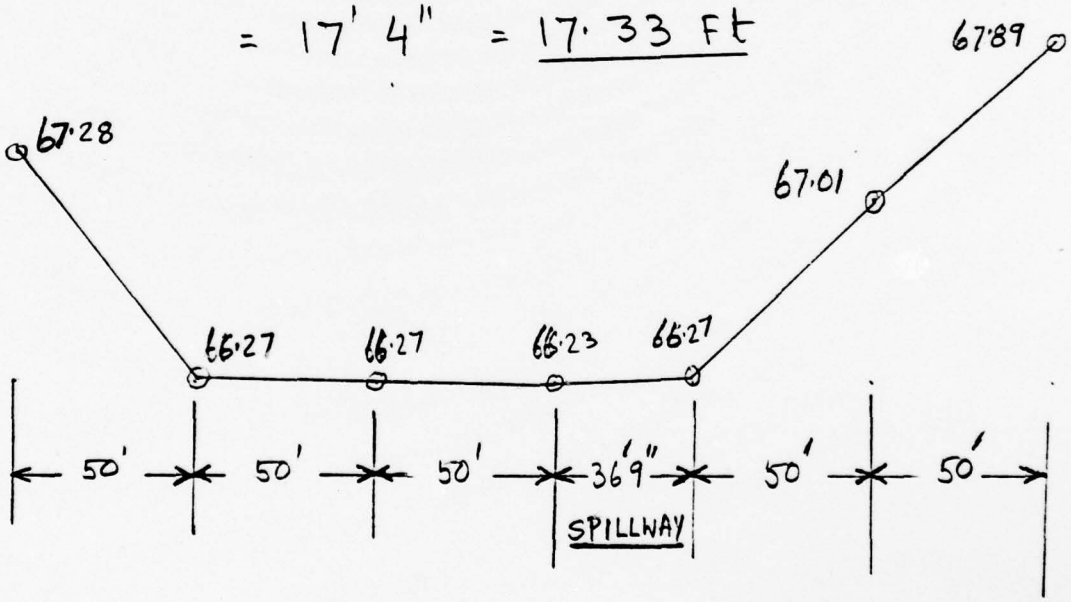
Spillway Rating Curve

Note:- All the elevations are to be added 20' to be consistent with USGS.

EL. of. Spillway = 41.05 + 20 = 61
Bottom of Roadway = 41.05 + 2.94 = 44 Ft + 20 = 64'

Length of Spillway = 36'-9" = 36.75 Ft (Gross)
OR. 3'-6" × 8 + 1' column × 9 = 37'
Eight (8) opening in Spillway

Length of Spillway (Net
= 8 [3'6" - (4" + 4" + 8")]
= 17' 4" = 17.33 Ft



Stage Outflow relations:

Length of Spillway = 17.33 Ft
Length of Roadway = L varies with depth
Hight above spillway = H (varies)
Hight above roadway = h (varies)

Outflow = $Q_{spillway} + Q_{press} + Q_{Roadway}$.

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CONSULTING ENGINEERS

SUBJECT N. J. Dam Inspection
Allentown Dam.
COMPUTED BY S. B. CHECKED BY

SHEET NO. 4 OF
JOB NO. 10-A20-01
DATE July, 1979

There is a difference of elevation between U.S.G.S datum and the datum shown in the drawings. Mr. William V.W. Cokelet, County Engineer was contacted, but he does not know anything about that. Road elevation estimated from the U.S.G.S Quad at it was observed There is a difference ~~around~~ of ±20' Ft elevation

Stage area calculations are based on that.

Spillway Rating Curve

Effective length of spillway = 17.33' = L_1
Elevation of spillway Crest = 41.05 ft Say 41.0 + 20
Bottom of Roadway = 44.0 ft + 20' = 64' = 61' msl
Top of Roadway = 46.23, 46.27, 46.27, 46.27
Assume 46.3 + 20' = 66.3
L = 136'9"

Beyond this length, 50 ft on each side top of roadway assumed Average between 66.3 and 67.3 ie 66.8 ft.

$$\text{Outflow} = Q_{\text{spillway}} + Q_{\text{pressure}} + Q_{\text{Central Road}} + Q_{\text{Side Roads}}$$

$$= 2.7 \times L_1 H_1^{1.5} + .63 \times A \sqrt{2g\Delta H} + 2.7 \times L_2 H_2^{1.5} + 2.7 L_3 H_3^{1.5}$$

$$= 2.7 \times 17.33 (E - 61)^{1.5} + .63 \times \left[17.33 \times (.67 - 61)\right] \times 8 \sqrt{E - 60}^{*}$$

$$+ 2.7 \times 136.75 \times (E - 66.3)^{1.5} + 2.7 \times 100 (E - 66.8)^{1.5}$$

$$= 46.8 (E - 61)^{1.5} + 262 \sqrt{E - 60} + 369.2 (E - 66.3)^{1.5}$$

$$+ 270 (E - 66.8)^{1.5}$$

* Tailwater is assumed at elevation 60'

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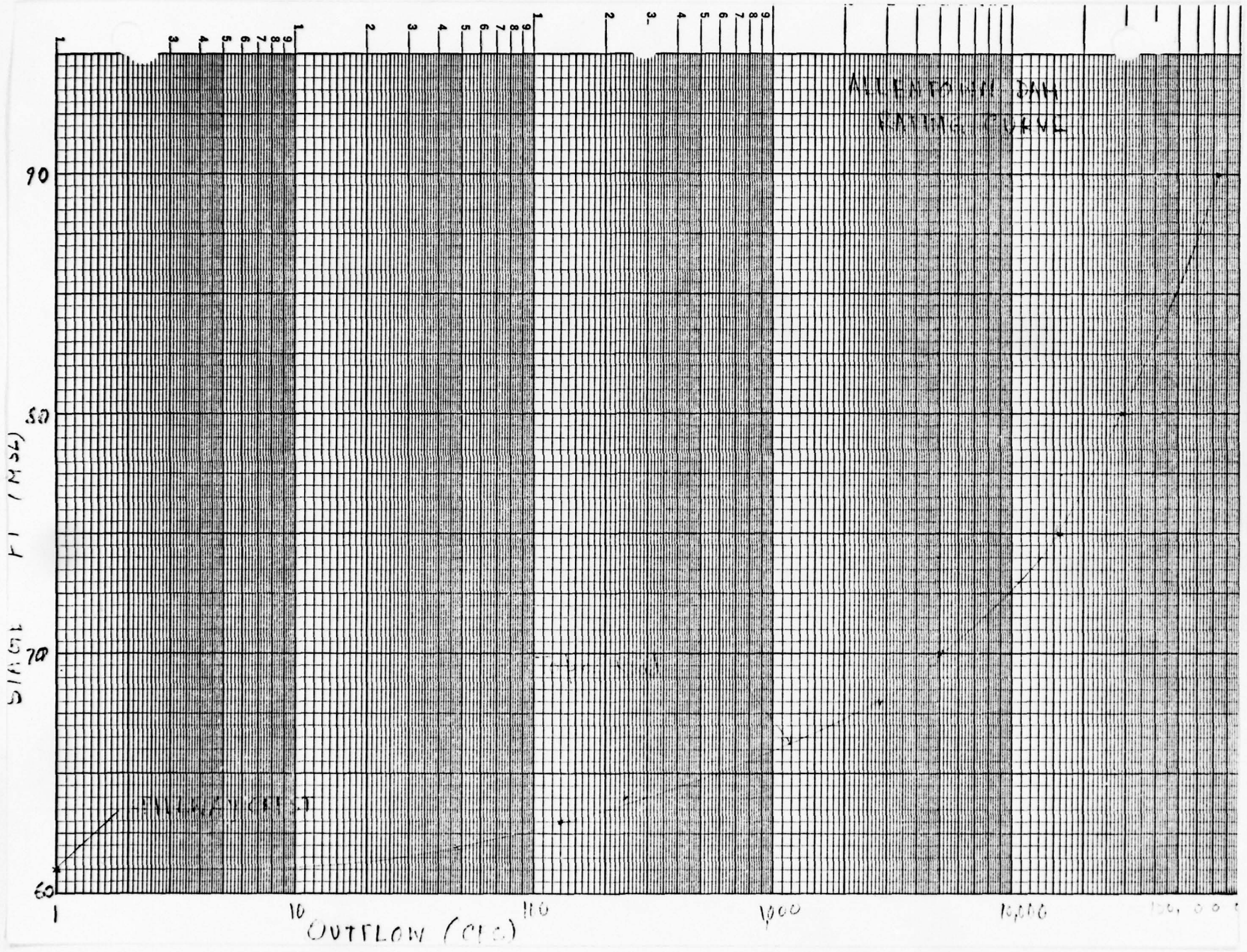
SUBJECT N.J. Dam Instruction — SHEET NO. 6 OF
JOB NO. 10-120-01
COMPUTED BY S.B CHECKED BY — DATE July 1979

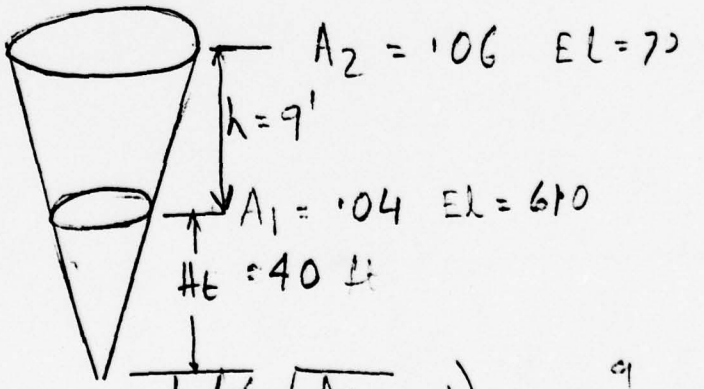
Elevation	spillway flow $46.8(E-61)^{1.5}$	& press $262\sqrt{E-60}$	& Central Road $369.2(E-63)^{1.5}$	& Side Road $270(E-66.8)^{1.5}$	Total
61	0	-	-	-	0
62	46.8				47
63	132.4				132
64	243.2				243
65		535.8			536
66		641.8			642
66.3		657.6			658
66.8		683.2	130.5	-	814
68		741.0	818.3	354.9	1,914
70		828.5	2,627.6	1,545.6	5,002
75		1,014.7	9,474.2	6,339.9	16,829
80		1171.7	18,721.6	12,948.6	32,842
90		1,435.0	42,597.5	30,171.4	74,204


ALTERNATIVE DAM
RATING CURVE
90
80
70
60
STAGE FT (MSL)
1
10
OUTFLOW (CFS)
100
1000
10,000

Reservoir

Stage area relations :—

Elevation	Area sq mile	Ac
Pool level (610	0.04	= 25.6
~~610~~ 70 +	0.06	= 38.4
80 +	0.10	= 64.0
90 +	0.37	= 236.8



$$h_t = h / \left(\sqrt{\frac{A_2}{A_1}} - 1\right) = \frac{9}{\left(\sqrt{\frac{.06}{.04}} - 1\right)} = 40$$

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SUBJECT N.J. Dam Inspection — Allentown Dam
SHEET NO. 9 OF
JOB NO. 10-A20-01
COMPUTED BY S.B. CHECKED BY
DATE July, 1979

Determination of PMP

PMP - P Card Field 2

Probable Maximum Precipitation amount from HMS Report 33

= 23" 200 Sq miles - 24 hrs
The all season envelope

Depth area. duration relationship
Percentage to be applied to the above figure.

ZONE 6

6 hr - 112
12 hrs - 123
24 hrs - 132
48 hrs - 143

Determination of Tc

From the upstream end to Imlaystown Lake

1) Estimating Tc from velocity estimate and watercourse length.

	Slope	Vel	Remarks
Overland flow	100/3600 = 2.78%	1.5	Pastures (upper portion of watershed)
Reach 1	50/3600 1.4%	1.5	Natural channel not well defined
Reach 2	50/22400 .22%	1.0	Natural channel Neglect flow thro' Imlaystown Lake

$$Tc = \frac{(3600 + 3600)}{1.5 \times 3600} + \frac{22400}{1 \times 3600} = 7.56 \text{ hrs.}$$

2) Estimating Tc assuming same vel

$$Tc = \frac{29600}{1.5 \times 3600} = 5.48 \text{ hrs.}$$

3) From Nomograph of Design of Small Dam (S.C.S Guide) — Same as Kirpich

$$Tc = \left(\frac{11.9\ L^3}{H}\right)^{.385}$$

L in Miles = 5.60 miles
H in feet = 200

$$= \left(\frac{11.9 \times (5.6)^3}{200}\right)^{.385} = 2.47 \text{ hrs.}$$

Use T_c = 5.2 hrs.

Lag = 0.6 T_c = 3.12 hrs.

T_c from Imlaystown Dam to Allentown Dam

① Slope = $\frac{30}{19200}$ = .15 %

V = 1.0 ft/sec Natural Channel

$$T_c = \frac{19200}{1 \times 3600} = 5.3 \text{ hrs.}$$

② From Nomograph

$$T_c = \left(\frac{11.9\ L^3}{H}\right)^{.385}$$

L = 3.63 miles
H = 30 ft

= 3.10 hrs

Use T_c = 4.2 hrs.

Lag = 0.6 T_c = 2.52 hrs.

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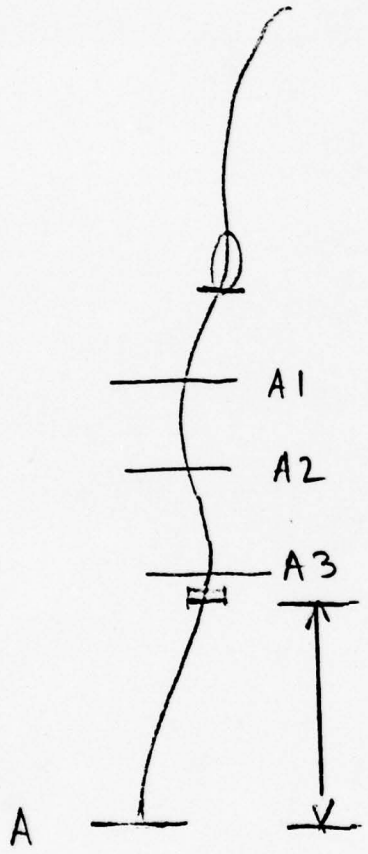
SUBJECT N.J. Dam Inspection — Allentown Dam
SHEET NO. 12 OF
JOB NO. 10-A20-01
COMPUTED BY S.B. CHECKED BY
DATE July, 1979

Schematic of Doctor's Creek for study of overtopping potential



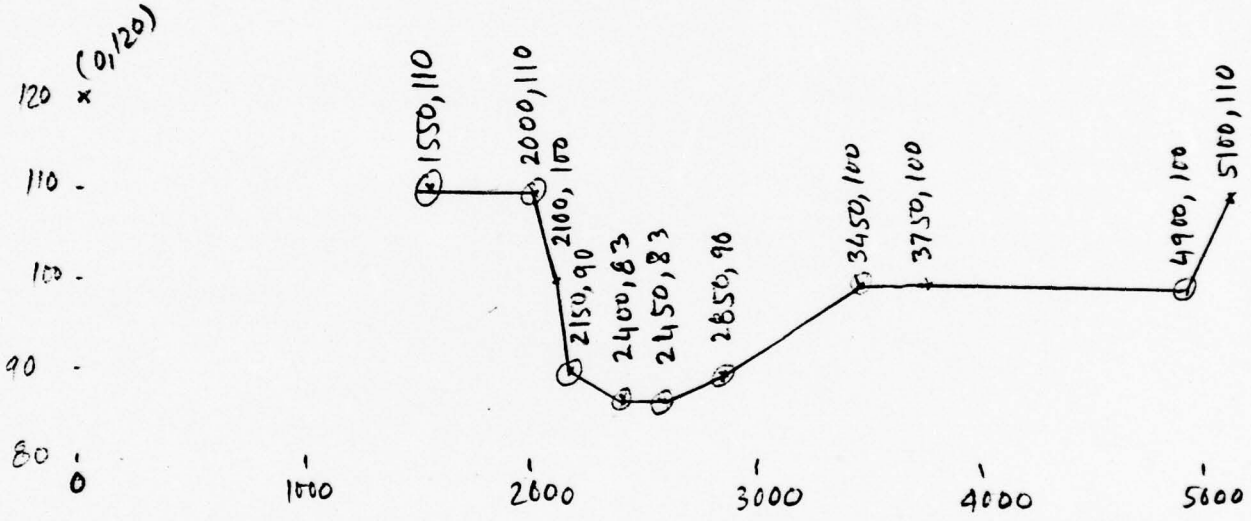
Imlaystown Reservoir
D.A = 8.8 sq miles

Allentown Dam
D.A = 17.4 sq miles

Three Sections are Chosen between Imlaystan Lake and Allentown Dam to consider the channel storage.

Section A1

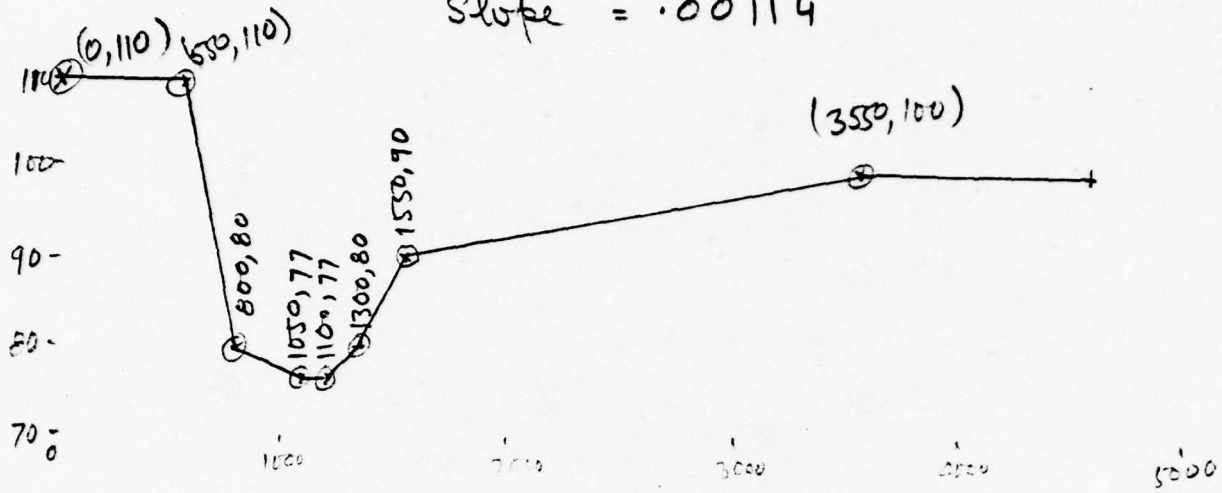
Distance ≈ 5700 from Imlaystown Lake



$$\text{Slope} = \frac{20}{8000} = .00125$$

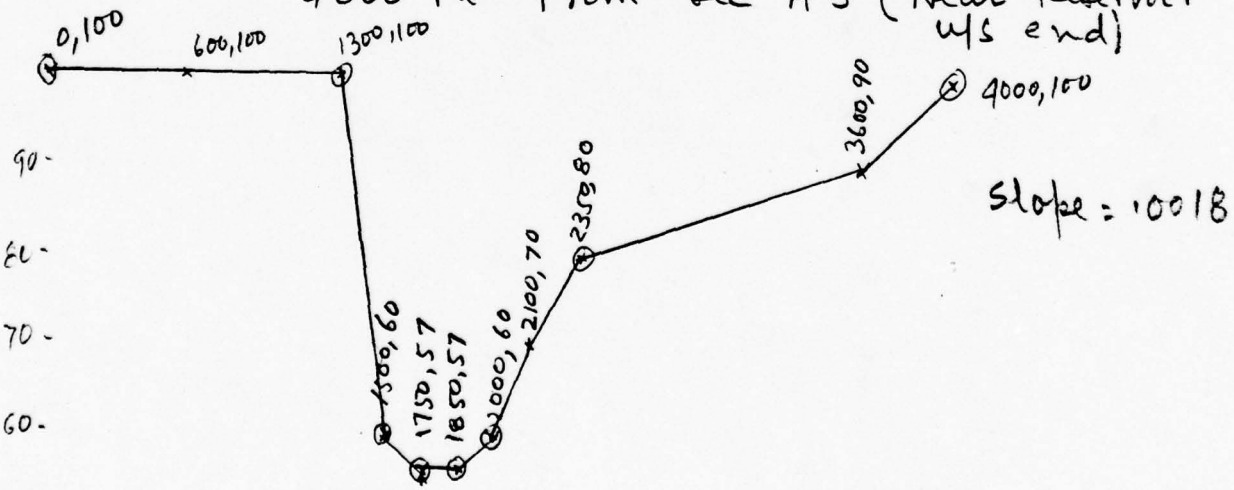
Section A2 → 8400 Ft from Sec A1

Slope = .00114



Section A3

4800 Ft From Sec A3 (Near Reservoir u/s end)



Slope = .0018

Value of n for all the above sections are chosen as .10, .06, .10

FREDERIC R. HARRIS, INC.
CONSULTING ENGINEERS

SUBJECT N.J. Dam Inspection
Allentown Dam

SHEET No. 15 OF

COMPUTED BY S.B CHECKED BY

JOB No. 10-A20-01

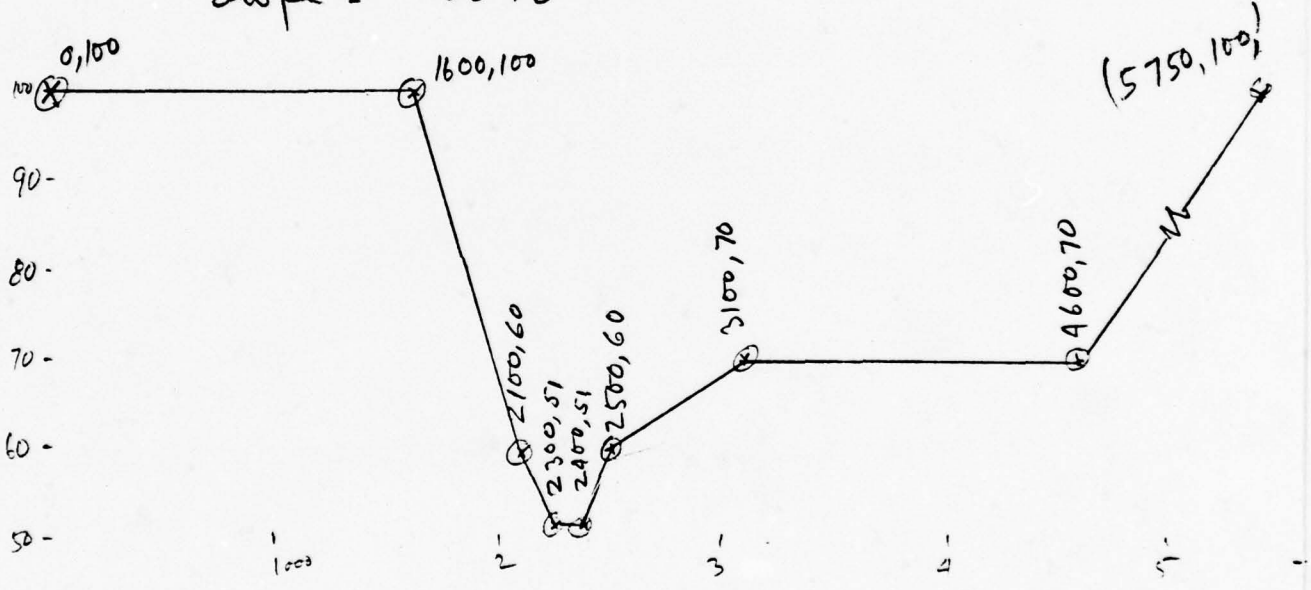
DATE August, 1979

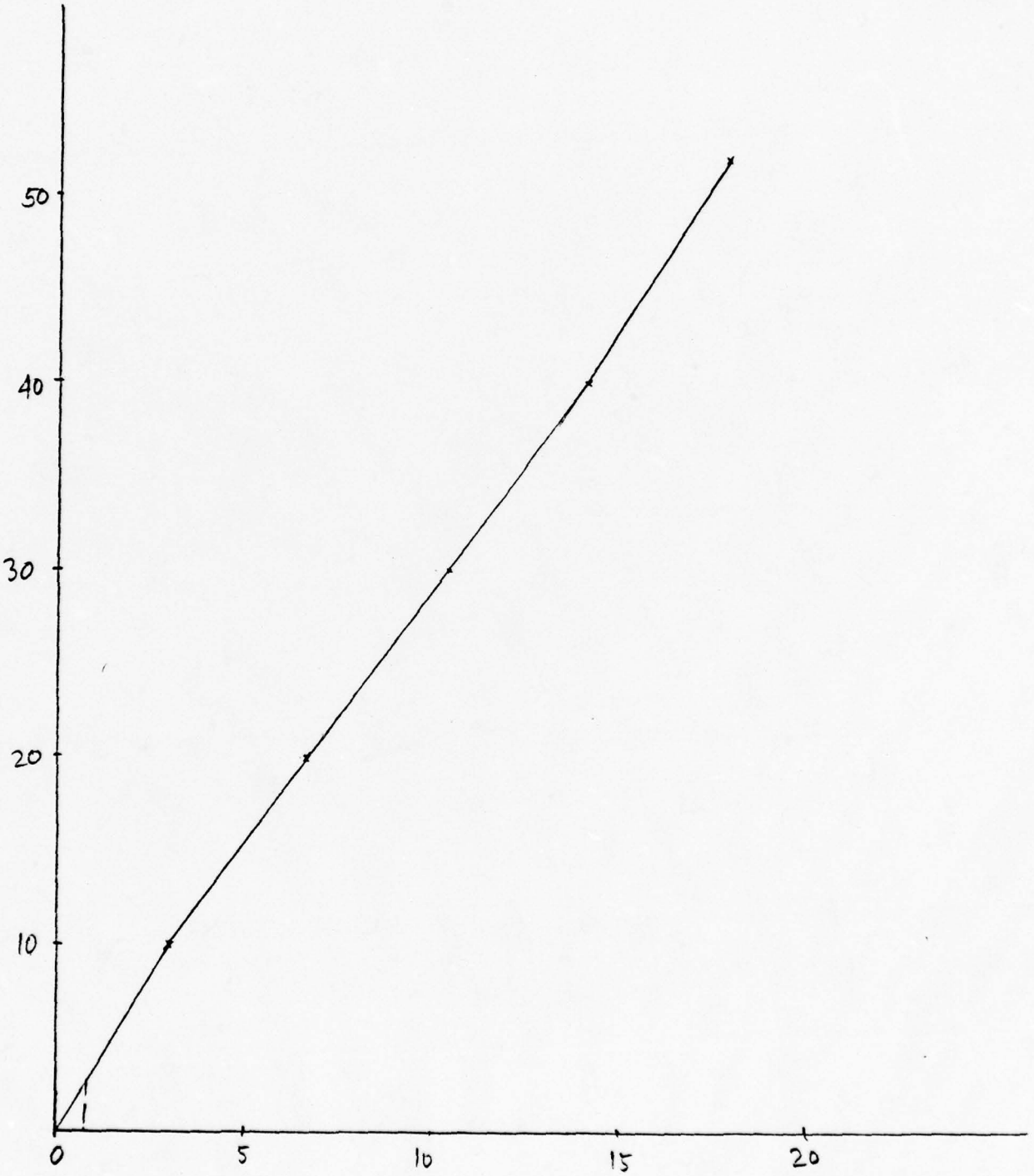
Cross section at the D/s of Allentown Dam.

There are many developements just downstream of Dam, surrounding the plunge-pool.

Reach 1

One section chosen at 800' D/s of Dam
slope = .0018



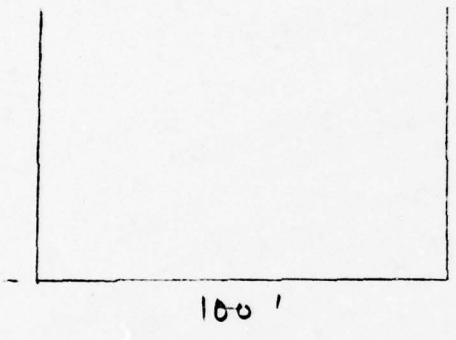


Outflow CFS in 10^3

○ Overtopping of Dam at el 66.3 Q = 751 cfs
at ≈ 3 % of PMF

Breach Analysis

Assume breach begins to develop where reservoir stage reaches 67.0, ie, 0.7 ft above Dam



Effect of breach was analysed at 800 ft D/S of Dam :-

	.5	.4	.3	.2	.1 of PMF
Maximum W.S El without Dam break	65.3	64.0	62.5	60.6	57.7
Maximum W.S El with Dam break	65.3	64.0	62.5	60.6	60.3

There will be no increase in stage due to Dam break for ½ PMF (SDF). However at 10% of PMF there will be 2.6 ft increase for Dam break.

At elevation 65.3' MSL the buildings to the right of the plunge pool will be submerged, erosion of the left bank is likely to be severe, endangering houses at the top of the bank, and the STP downstream is likely to be severely

HEC1-DB

COMPUTER PRINT-OUT

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1                A1      N.J. DAM INSPECTION
    2                A2      N.J. 00308 ALLENTOWN DAM
    3                A3      MULTI RATIO PMF ROUTING
    4                B   150       0      30       0       0       0       0       0       0
    5                B1    5
    6                J     1       5       1
    7                J1   .5      .4      .3      .2      .1
    8                K     0 IML.RES                                       1
    9                K1      LOCAL INFLOW TO IMLAYSTOWN DAM
   10                M     1       2     8.8                     8.8                       1
   11                P     0      23     112     123     132
   12                T                                                     1     .04               .01
   13                W2          3.12
   14                X     1  -0.05       2
   15                K     1      A1                                       1
   16                K1      CHANNEL ROUTING BY MOD. PULS.(SEC A1)
   17                Y                                     1       1
   18                Y1    1
   19                Y6   .1     .06      .1      83      90    5700   .00125
   20                Y7 1550     110    2000     110    2150      90    2400      83    2450      83
   21                Y7 2850      90    3450     100    4900     100
   22                K     1      A2                                       1
   23                K1      CHANNEL ROUTING BY MOD. PULS.(SEC A2)
   24                Y                                     1       1
   25                Y1    1
   26                Y6   .1     .06      .1      77      85    8400   .00114
   27                Y7    0     110     550     110     800      80    1050      77    1100      77
   28                Y7 1300      80    1550      90    1350     100
   29                K     1    DAM                                        1
   30                K1      CHANNEL ROUTING BY MOD. PULS.(SEC A3)
   31                Y                                     1       1
   32                Y1    1
   33                Y6   .1     .06      .1      57      65    4800    .0018
   34                Y7    0     100    1300     100    1500      60    1750      57    1850      57
   35                Y7 2000      60    2350      80    4000     100
   36                K     0     DAM                                       1
   37                K1      LOCAL INFLOW FROM IMLAYSTOWN TO ALLENTOWN DAM
   38                M     1       2     8.6                     8.6                       1
   39                P     0      23     112     123     132
   40                T                                                     1     .04               .01
   41                W2          2.52
   42                X     1  -0.05       2       2
   43                K     2     DAM                                       1
   44                K1      COMBINE HYDROGRAPH AT DAM
   45                K     1     DAM                                       1
   46                K1      ROUTING THROUGH ALLENTOWN DAM
   47                Y                                     1       1
   48                Y1    1                                         -51.0      -1
   49                Y4   61      62      64      65    66.8      68      70      75      80      90
   50                Y5    0      47     243     586     814    1914    5002   16829   32842   74204
```

```
$A      0    25.6    38.4      64   236.8
$E     21      61      70      80      90
$$     61
$D   66.3
K       1  REACH1                                                  1
K1        CHANNEL ROUTING MOD. PULS.  REACH 1
Y                                     1       1
Y1      1
Y6     .1     .06      .1      52      65     800    .0018
Y7      0     100    1600     100    2100      60    2300      51    2400      51
Y7   2500      60    3100      70    4600      70
K      99
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

```
RUNOFF HYDROGRAPH AT        ML.RES
ROUTE HYDROGRAPH TO            A1
ROUTE HYDROGRAPH TO            A2
ROUTE HYDROGRAPH TO           DAM
RUNOFF HYDROGRAPH AT          DAM
COMBINE  2 HYDROGRAPHS AT     DAM
ROUTE HYDROGRAPH TO           DAM
ROUTE HYDROGRAPH TO         REACH1
END OF NETWORK
```

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE# 79/08/29.
TIME# 07.51.10.

N.J. DAM INSPECTION
N.J. 00308 ALLENTOWN DAM
MULTI RATIO PMF ROUTING

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	30	0	0	0	0	0	0	0
			JUPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 5 LRTIO= 1
RTIOS= .50 .40 .30 .20 .10

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW TO IMLAYSTOWN DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
ML.RES	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	8.80	0.00	8.80	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.00	112.00	123.00	132.00	0.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.04	0.00	.01

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= 3.12

RECESSION DATA
STRTQ= 1.00 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 33 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= 3.12 VOL= 1.00

81.	236.	482.	816.	1092.	1241.	1256.	1182.	1049.	878.
666.	509.	398.	317.	251.	195.	154.	122.	94.	74.
58.	46.	36.	28.	22.	17.	14.	12.	9.	7.
5.	3.	1.							

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

1.01	.30	1	.06	.00	.05	1.	1.02	14.00	76	0.00	0.00	0.00	226.
1.01	1.00	2	.06	.00	.05	1.	1.02	14.30	77	0.00	0.00	0.00	210.
1.01	1.30	3	.06	.00	.05	1.	1.02	15.00	78	0.00	0.00	0.00	196.
1.01	2.00	4	.06	.00	.05	2.	1.02	15.30	79	0.00	0.00	0.00	183.
1.01	2.30	5	.06	.00	.05	2.	1.02	16.00	80	0.00	0.00	0.00	171.
1.01	3.00	6	.06	.00	.05	3.	1.02	16.30	81	0.00	0.00	0.00	160.
1.01	3.30	7	.06	.00	.05	3.	1.02	17.00	82	0.00	0.00	0.00	149.
1.01	4.00	8	.06	.00	.05	4.	1.02	17.30	83	0.00	0.00	0.00	139.
1.01	4.30	9	.06	.00	.05	5.	1.02	18.00	84	0.00	0.00	0.00	130.
1.01	5.00	10	.06	.00	.05	5.	1.02	18.30	85	0.00	0.00	0.00	121.
1.01	5.30	11	.06	.00	.05	5.	1.02	19.00	86	0.00	0.00	0.00	113.
1.01	6.00	12	.06	.00	.05	6.	1.02	19.30	87	0.00	0.00	0.00	105.
1.01	6.30	13	.17	.00	.17	6.	1.02	20.00	88	0.00	0.00	0.00	98.
1.01	7.00	14	.17	.00	.17	6.	1.02	20.30	89	0.00	0.00	0.00	92.
1.01	7.30	15	.17	.15	.02	19.	1.02	21.00	90	0.00	0.00	0.00	85.
1.01	8.00	16	.17	.15	.02	55.	1.02	21.30	91	0.00	0.00	0.00	80.
1.01	8.30	17	.17	.15	.02	127.	1.02	22.00	92	0.00	0.00	0.00	74.
1.01	9.00	18	.17	.15	.02	248.	1.02	22.30	93	0.00	0.00	0.00	69.
1.01	9.30	19	.17	.15	.02	410.	1.02	23.00	94	0.00	0.00	0.00	65.
1.01	10.00	20	.17	.15	.02	594.	1.02	23.30	95	0.00	0.00	0.00	60.
1.01	10.30	21	.17	.15	.02	780.	1.03	0.00	96	0.00	0.00	0.00	56.
1.01	11.00	22	.17	.15	.02	955.	1.03	.30	97	0.00	0.00	0.00	53.
1.01	11.30	23	.17	.15	.02	1110.	1.03	1.00	98	0.00	0.00	0.00	49.
1.01	12.00	24	.17	.15	.02	1240.	1.03	1.30	99	0.00	0.00	0.00	46.
1.01	12.30	25	1.03	1.01	.02	1408.	1.03	2.00	100	0.00	0.00	0.00	43.
1.01	13.00	26	1.03	1.01	.02	1687.	1.03	2.30	101	0.00	0.00	0.00	40.
1.01	13.30	27	1.24	1.22	.02	2177.	1.03	3.00	102	0.00	0.00	0.00	37.
1.01	14.00	28	1.24	1.22	.02	2976.	1.03	3.30	103	0.00	0.00	0.00	35.
1.01	14.30	29	1.55	1.53	.02	4079.	1.03	4.00	104	0.00	0.00	0.00	32.
1.01	15.00	30	1.55	1.53	.02	5418.	1.03	4.30	105	0.00	0.00	0.00	30.
1.01	15.30	31	1.88	1.86	.02	6923.	1.03	5.00	106	0.00	0.00	0.00	28.
1.01	16.00	32	5.95	5.93	.02	8875.	1.03	5.30	107	0.00	0.00	0.00	26.
1.01	16.30	33	1.44	1.42	.02	11147.	1.03	6.00	108	0.00	0.00	0.00	25.
1.01	17.00	34	1.44	1.42	.02	13713.	1.03	6.30	109	0.00	0.00	0.00	23.
1.01	17.30	35	1.13	1.11	.02	16391.	1.03	7.00	110	0.00	0.00	0.00	21.
1.01	18.00	36	1.13	1.11	.02	18488.	1.03	7.30	111	0.00	0.00	0.00	20.
1.01	18.30	37	.08	.06	.02	19613.	1.03	8.00	112	0.00	0.00	0.00	19.
1.01	19.00	38	.08	.06	.02	19681.	1.03	8.30	113	0.00	0.00	0.00	17.
1.01	19.30	39	.08	.06	.02	18847.	1.03	9.00	114	0.00	0.00	0.00	16.
1.01	20.00	40	.08	.06	.02	17231.	1.03	9.30	115	0.00	0.00	0.00	15.
1.01	20.30	41	.08	.06	.02	15075.	1.03	10.00	116	0.00	0.00	0.00	14.
1.01	21.00	42	.08	.06	.02	12573.	1.03	10.30	117	0.00	0.00	0.00	13.
1.01	21.30	43	.08	.06	.02	10326.	1.03	11.00	118	0.00	0.00	0.00	12.
1.01	22.00	44	.08	.06	.02	8394.	1.03	11.30	119	0.00	0.00	0.00	11.
1.01	22.30	45	.08	.06	.02	6787.	1.03	12.00	120	0.00	0.00	0.00	11.
1.01	23.00	46	.08	.06	.02	5458.	1.03	12.30	121	0.00	0.00	0.00	10.
1.01	23.30	47	.08	.06	.02	4421.	1.03	13.00	122	0.00	0.00	0.00	9.
1.02	0.00	48	.08	.06	.02	3634.	1.03	13.30	123	0.00	0.00	0.00	9.
1.02	.30	49	0.00	0.00	0.00	3008.	1.03	14.00	124	0.00	0.00	0.00	8.
1.02	1.00	50	0.00	0.00	0.00	2496.	1.03	14.30	125	0.00	0.00	0.00	8.
1.02	1.30	51	0.00	0.00	0.00	2076.	1.03	15.00	126	0.00	0.00	0.00	7.
1.02	2.00	52	0.00	0.00	0.00	1724.	1.03	15.30	127	0.00	0.00	0.00	7.
1.02	2.30	53	0.00	0.00	0.00	1417.	1.03	16.00	128	0.00	0.00	0.00	6.
1.02	3.00	54	0.00	0.00	0.00	1151.	1.03	16.30	129	0.00	0.00	0.00	6.
1.02	3.30	55	0.00	0.00	0.00	967.	1.03	17.00	130	0.00	0.00	0.00	5.
1.02	4.00	56	0.00	0.00	0.00	902.	1.03	17.30	131	0.00	0.00	0.00	5.
1.02	4.30	57	0.00	0.00	0.00	842.	1.03	18.00	132	0.00	0.00	0.00	5.
1.02	5.00	58	0.00	0.00	0.00	786.	1.03	18.30	133	0.00	0.00	0.00	4.
1.02	5.30	59	0.00	0.00	0.00	733.	1.03	19.00	134	0.00	0.00	0.00	4.
1.02	6.00	60	0.00	0.00	0.00	684.	1.03	19.30	135	0.00	0.00	0.00	4.
1.02	6.30	61	0.00	0.00	0.00	638.	1.03	20.00	136	0.00	0.00	0.00	4.
1.02	7.00	62	0.00	0.00	0.00	595.	1.03	20.30	137	0.00	0.00	0.00	3.
1.02	7.30	63	0.00	0.00	0.00	555.	1.03	21.00	138	0.00	0.00	0.00	3.
1.02	8.00	64	0.00	0.00	0.00	518.	1.03	21.30	139	0.00	0.00	0.00	3.
1.02	8.30	65	0.00	0.00	0.00	484.	1.03	22.00	140	0.00	0.00	0.00	3.
1.02	9.00	66	0.00	0.00	0.00	451.	1.03	22.30	141	0.00	0.00	0.00	2.

		[illegible]	[illegible]	[illegible]	.05	4.
1.01	4.30	9	.06	.00	.05	5.
1.01	5.00	10	.06	.00	.05	5.
1.01	5.30	11	.06	.00	.05	5.
1.01	6.00	12	.06	.00	.05	6.
1.01	6.30	13	.17	.00	.17	6.
1.01	7.00	14	.17	.00	.17	6.
1.01	7.30	15	.17	.15	.02	19.
1.01	8.00	16	.17	.15	.02	55.
1.01	8.30	17	.17	.15	.02	127.
1.01	9.00	18	.17	.15	.02	248.
1.01	9.30	19	.17	.15	.02	410.
1.01	10.00	20	.17	.15	.02	594.
1.01	10.30	21	.17	.15	.02	780.
1.01	11.00	22	.17	.15	.02	955.
1.01	11.30	23	.17	.15	.02	1110.
1.01	12.00	24	.17	.15	.02	1240.
1.01	12.30	25	1.03	1.01	.02	1408.
1.01	13.00	26	1.03	1.01	.02	1687.
1.01	13.30	27	1.24	1.22	.02	2177.
1.01	14.00	28	1.24	1.22	.02	2976.
1.01	14.30	29	1.55	1.53	.02	4079.
1.01	15.00	30	1.55	1.53	.02	5418.
1.01	15.30	31	1.88	1.86	.02	6923.
1.01	16.00	32	5.95	5.93	.02	8875.
1.01	16.30	33	1.44	1.42	.02	11147.
1.01	17.00	34	1.44	1.42	.02	13713.
1.01	17.30	35	1.13	1.11	.02	16391.
1.01	18.00	36	1.13	1.11	.02	18488.
1.01	18.30	37	.08	.06	.02	19613.
1.01	19.00	38	.08	.06	.02	19681.
1.01	19.30	39	.08	.06	.02	18847.
1.01	20.00	40	.08	.06	.02	17231.
1.01	20.30	41	.08	.06	.02	15075.
1.01	21.00	42	.08	.06	.02	12573.
1.01	21.30	43	.08	.06	.02	10326.
1.01	22.00	44	.08	.06	.02	8394.
1.01	22.30	45	.08	.06	.02	6787.
1.01	23.00	46	.08	.06	.02	5458.
1.01	23.30	47	.08	.06	.02	4421.
1.02	0.00	48	.08	.06	.02	3634.
1.02	.30	49	0.00	0.00	0.00	3008.
1.02	1.00	50	0.00	0.00	0.00	2496.
1.02	1.30	51	0.00	0.00	0.00	2076.
1.02	2.00	52	0.00	0.00	0.00	1724.
1.02	2.30	53	0.00	0.00	0.00	1417.
1.02	3.00	54	0.00	0.00	0.00	1151.
1.02	3.30	55	0.00	0.00	0.00	967.
1.02	4.00	56	0.00	0.00	0.00	902.
1.02	4.30	57	0.00	0.00	0.00	842.
1.02	5.00	58	0.00	0.00	0.00	786.
1.02	5.30	59	0.00	0.00	0.00	733.
1.02	6.00	60	0.00	0.00	0.00	684.
1.02	6.30	61	0.00	0.00	0.00	638.
1.02	7.00	62	0.00	0.00	0.00	595.
1.02	7.30	63	0.00	0.00	0.00	555.
1.02	8.00	64	0.00	0.00	0.00	518.
1.02	8.30	65	0.00	0.00	0.00	484.
1.02	9.00	66	0.00	0.00	0.00	451.

		[illegible]	[illegible]	[illegible]	0.00	149.
1.02	17.30	83	0.00	0.00	0.00	139.
1.02	18.00	84	0.00	0.00	0.00	130.
1.02	18.30	85	0.00	0.00	0.00	121.
1.02	19.00	86	0.00	0.00	0.00	113.
1.02	19.30	87	0.00	0.00	0.00	105.
1.02	20.00	88	0.00	0.00	0.00	98.
1.02	20.30	89	0.00	0.00	0.00	92.
1.02	21.00	90	0.00	0.00	0.00	85.
1.02	21.30	91	0.00	0.00	0.00	80.
1.02	22.00	92	0.00	0.00	0.00	74.
1.02	22.30	93	0.00	0.00	0.00	69.
1.02	23.00	94	0.00	0.00	0.00	65.
1.02	23.30	95	0.00	0.00	0.00	60.
1.03	0.00	96	0.00	0.00	0.00	56.
1.03	.30	97	0.00	0.00	0.00	53.
1.03	1.00	98	0.00	0.00	0.00	49.
1.03	1.30	99	0.00	0.00	0.00	46.
1.03	2.00	100	0.00	0.00	0.00	43.
1.03	2.30	101	0.00	0.00	0.00	40.
1.03	3.00	102	0.00	0.00	0.00	37.
1.03	3.30	103	0.00	0.00	0.00	35.
1.03	4.00	104	0.00	0.00	0.00	32.
1.03	4.30	105	0.00	0.00	0.00	30.
1.03	5.00	106	0.00	0.00	0.00	28.
1.03	5.30	107	0.00	0.00	0.00	26.
1.03	6.00	108	0.00	0.00	0.00	25.
1.03	6.30	109	0.00	0.00	0.00	23.
1.03	7.00	110	0.00	0.00	0.00	21.
1.03	7.30	111	0.00	0.00	0.00	20.
1.03	8.00	112	0.00	0.00	0.00	19.
1.03	8.30	113	0.00	0.00	0.00	17.
1.03	9.00	114	0.00	0.00	0.00	16.
1.03	9.30	115	0.00	0.00	0.00	15.
1.03	10.00	116	0.00	0.00	0.00	14.
1.03	10.30	117	0.00	0.00	0.00	13.
1.03	11.00	118	0.00	0.00	0.00	12.
1.03	11.30	119	0.00	0.00	0.00	11.
1.03	12.00	120	0.00	0.00	0.00	11.
1.03	12.30	121	0.00	0.00	0.00	10.
1.03	13.00	122	0.00	0.00	0.00	9.
1.03	13.30	123	0.00	0.00	0.00	9.
1.03	14.00	124	0.00	0.00	0.00	8.
1.03	14.30	125	0.00	0.00	0.00	8.
1.03	15.00	126	0.00	0.00	0.00	7.
1.03	15.30	127	0.00	0.00	0.00	7.
1.03	16.00	128	0.00	0.00	0.00	6.
1.03	16.30	129	0.00	0.00	0.00	6.
1.03	17.00	130	0.00	0.00	0.00	5.
1.03	17.30	131	0.00	0.00	0.00	5.
1.03	18.00	132	0.00	0.00	0.00	5.
1.03	18.30	133	0.00	0.00	0.00	4.
1.03	19.00	134	0.00	0.00	0.00	4.
1.03	19.30	135	0.00	0.00	0.00	4.
1.03	20.00	136	0.00	0.00	0.00	4.
1.03	20.30	137	0.00	0.00	0.00	3.
1.03	21.00	138	0.00	0.00	0.00	3.
1.03	21.30	139	0.00	0.00	0.00	3.
1.03	22.00	140	0.00	0.00	0.00	3.
1.03	22.30	141	0.00	0.00	0.00	2.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .40	RATIO 3 .30	RATIO 4 .20	RATIO 5 .10
HYDROGRAPH AT	ML.RES	8.80	1	9841.	7873.	5904.	3936.	1968.
		(22.79)		(278.66)(	222.92)(	167.19)(	111.46)(	55.73)(
ROUTED TO	A1	8.80	1	9568.	7653.	5736.	3805.	1876.
		(22.79)		(270.93)(	216.72)(	162.43)(	107.75)(	53.12)(
ROUTED TO	A2	8.80	1	9306.	7405.	5494.	3566.	1700.
		(22.79)		(263.52)(	209.69)(	155.58)(	100.97)(	48.14)(
ROUTED TO	DAM	8.80	1	9200.	7313.	5436.	3533.	1655.
		(22.79)		(260.52)(	207.07)(	153.92)(	100.04)(	46.86)(
HYDROGRAPH AT	DAM	8.60	1	10702.	8561.	6421.	4281.	2140.
		(22.27)		(303.04)(	242.43)(	181.82)(	121.22)(	60.61)(
2 COMBINED	DAM	17.40	1	17942.	14165.	10385.	6649.	2973.
		(45.07)		(508.06)(	401.11)(	294.08)(	188.27)(	84.17)(
ROUTED TO	DAM	17.40	1	17815.	14088.	10361.	6651.	2957.
		(45.07)		(504.45)(	398.93)(	293.39)(	188.33)(	83.74)(
ROUTED TO	REACH1	17.40	1	17873.	14094.	10369.	6639.	2964.
		(45.07)		(506.11)(	399.09)(	293.61)(	187.99)(	83.94)(

PLAN 1 STATION A1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9568.	92.1	19.50
.40	7653.	91.1	19.50
.30	5736.	90.1	19.50
.20	3805.	89.0	19.50
.10	1876.	87.5	19.50

PLAN 1 STATION A2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9306.	84.6	20.00
.40	7405.	83.9	20.00
.30	5494.	83.0	20.00
.20	3566.	81.9	20.00
.10	1700.	80.7	20.50

PLAN 1 STATION DAM

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9200.	63.7	20.00
.40	7313.	63.0	20.50
.30	5436.	62.2	20.50
.20	3533.	61.3	20.50
.10	1655.	60.2	21.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	51.00	61.00	66.30
STORAGE	144.	341.	496.
OUTFLOW	0.	0.	751.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	75.31	9.01	864.	17815.	19.00	19.50	0.00
.40	73.84	7.54	792.	14088.	17.50	19.50	0.00
.30	72.27	5.97	720.	10361.	16.00	19.50	0.00
.20	70.70	4.40	655.	6651.	14.00	19.50	0.00
.10	68.68	2.38	578.	2957.	10.00	19.50	0.00

PLAN 1 STATION REACH1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	17873.	65.3	19.50
.40	14094.	64.0	19.50
.30	10369.	62.5	19.50
.20	6639.	60.6	19.50
.10	2964.	57.7	19.50

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
    1              A1      N.J. DAM INSPECTION
    2              A2      N.J. 00308 ALLENTOWN DAM
    3              A3      ~~MULTI-RATIO PMF ROUTING~~ DAM FAILURE ANALYSIS
    4              B    150       0      30       0       0       0       0       0       0       0
    5              B1     5
    6              J      1       5       1
    7              J1    .5      .4      .3      .2      .1
    8              K      0 IML.RES                                       1
    9              K1      LOCAL INFLOW TO IMLAYSTOWN DAM
   10              M      1       2     8.8               8.8                                     1
   11              P      0      23     112     123     132
   12              T                                                      1     .04               .01
   13              W2           3.12
   14              X      1   -0.05       2
   15              K      1      A1                                       1
   16              K1      CHANNEL ROUTING BY MOD. PULS.(SEC A1)
   17              Y                              1       1
   18              Y1     1
   19              Y6    .1      .06     .1      83      90    5700   .00125
   20              Y7  1550      110    2000     110    2150      90    2400      83    2450      83
   21              Y7  2850       90    3450     100    4900     100
   22              K      1      A2                                       1
   23              K1      CHANNEL ROUTING BY MOD. PULS.(SEC A2)
   24              Y                              1       1
   25              Y1     1
   26              Y6    .1      .06     .1      77      85    8400   .00114
   27              Y7     0      110     550     110     800      80    1050      77    1100      77
   28              Y7  1300       80    1550      90    1350     100
   29              K      1   DAM                                         1
   30              K1      CHANNEL ROUTING BY MOD. PULS.(SEC A3)
   31              Y                              1       1
   32              Y1     1
   33              Y6    .1      .06     .1      57      65    4800    .0018
   34              Y7     0      100    1300     100    1500      60    1750      57    1850      57
   35              Y7  2000       60    2350      80    4000     100
   36              K      0     DAM                                       1
   37              K1      LOCAL INFLOW FROM IMLAYSTOWN TO ALLENTOWN DAM
   38              M      1       2     8.6               8.6                                     1
   39              P      0      23     112     123     132
   40              T                                                      1     .04               .01
   41              W2           2.52
   42              X      1   -0.05       2       2
   43              K      2     DAM                                       1
   44              K1      COMBINE HYDROGRAPH AT DAM
   45              K      1     DAM                                       1
   46              K1      ROUTING THROUGH ALLENTOWN DAM
   47              Y                              1       1
   48              Y1     1                                       -51.0      -1
   49              Y4    61      62      64      65    66.8      68      70      75      80      90
   50              Y5     0      47     243     586     814    1914    5002   16829   32842   74204
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51              $A      0    25.6     38.4       64    236.8
52              $E     21      61       70       80       90
53              $$     61
54              $D   66.3
55              $B    100                55        1       61       67
56              K       1  REACH1                                          1
57              K1        CHANNEL ROUTING MOD. PULS.  REACH 1
58              Y                                    1        1
59              Y1      1
60              Y6     .1     .06       .1       52       65      800    .0018
61              Y7      0      100     1600      100     2100       60     2300      51     2400      51
62              Y7   2500       60     3100       70     4600       70
63              K      99
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PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

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RUNOFF HYDROGRAPH AT        ML.RES
ROUTE HYDROGRAPH TO            A1
ROUTE HYDROGRAPH TO            A2
ROUTE HYDROGRAPH TO           DAM
RUNOFF HYDROGRAPH AT          DAM
COMBINE  2 HYDROGRAPHS AT     DAM
ROUTE HYDROGRAPH TO           DAM
ROUTE HYDROGRAPH TO        REACH1
END OF NETWORK
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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE= 79/08/29.
     TIME= 07.51.00.


                    N.J. DAM INSPECTION
                    N.J. 00308 ALLENTOWN DAM
                    MULTI RATIO PMF ROUTING

                              JOB SPECIFICATION
      NQ     NHR     NMIN     IDAY     IHR     IMIN    METRC     IPLT     IPRT    NSTAN
     150       0       30        0       0        0        0        0        0        0
                            JOPER      NWT   LROPT   TRACE
                                5        0       0       0


                         MULTI-PLAN ANALYSES TO BE PERFORMED
                                NPLAN= 1 NRTIO= 5 LRTIO= 1
                RTIOS=     .50     .40     .30     .20     .10


**********      **********      **********      **********      **********

                         SUB-AREA RUNOFF COMPUTATION

                LOCAL INFLOW TO IMLAYSTOWN DAM

                          ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                         ML.RES       0       0       0       0       0       1       0       0

                                  HYDROGRAPH DATA
            IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
                1       2    8.80    0.00    8.80    0.00   0.000       0       1       0

                                  PRECIP DATA
                         SPFE     PMS      R6     R12     R24     R48     R72     R96
                         0.00   23.00  112.00  123.00  132.00    0.00    0.00    0.00
TRSPC COMPUTED BY THE PROGRAM IS  .800

                                  LOSS DATA
        LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
            0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .04    0.00     .01

                              UNIT HYDROGRAPH DATA
                        TC=  0.00    LAG=  3.12

                              RECESSION DATA
                       STRTQ=    1.00    QRCSN=    -.05    RTIOR= 2.00

      UNIT HYDROGRAPH 33 END OF PERIOD ORDINATES, TC=    0.00 HOURS, LAG=   3.12  VOL= 1.00
     81.     236.     482.     816.    1092.    1241.    1256.    1182.    1049.     878.
    666.     509.     398.     317.     251.     195.     154.     122.      94.      74.
     58.      46.      36.      28.      22.      17.      14.      12.       9.       7.
      5.       3.       1.

  0                              END-OF-PERIOD FLOW
 MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q      MO.DA  HR.MN  PERIOD   RAIN   EXCS   LOSS    COMP Q
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AD-A074 586 NEW JERSEY DEPT OF ENVIRONMENTAL PROTECTION TRENTON F/G 13/2
NATIONAL DAM SAFETY PROGRAM. ALLENTOWN DAM (NJ-00308). DELAWARE--ETC(U)
AUG 79 A G POSCH DACW61-79-C-0011

UNCLASSIFIED NL

2 OF 2
AD
A074 586

END
DATE FILMED
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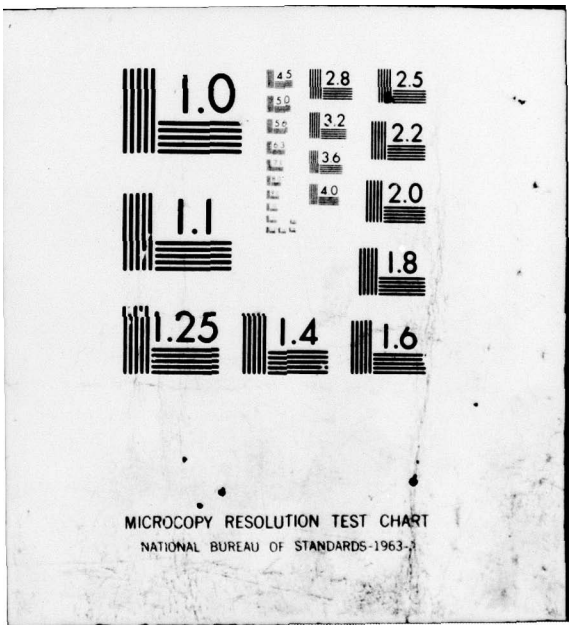
1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
4.5
5.0
5.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

1.01	.30	1	.06	.00	.05	1.	1.02	14.00	76	0.00	0.00	0.00	220.
1.01	1.00	2	.06	.00	.05	1.	1.02	14.30	77	0.00	0.00	0.00	210.
1.01	1.30	3	.06	.00	.05	1.	1.02	15.00	78	0.00	0.00	0.00	196.
1.01	2.00	4	.06	.00	.05	2.	1.02	15.30	79	0.00	0.00	0.00	183.
1.01	2.30	5	.06	.00	.05	2.	1.02	16.00	80	0.00	0.00	0.00	171.
1.01	3.00	6	.06	.00	.05	3.	1.02	16.30	81	0.00	0.00	0.00	160.
1.01	3.30	7	.06	.00	.05	3.	1.02	17.00	82	0.00	0.00	0.00	149.
1.01	4.00	8	.06	.00	.05	4.	1.02	17.30	83	0.00	0.00	0.00	139.
1.01	4.30	9	.06	.00	.05	5.	1.02	18.00	84	0.00	0.00	0.00	130.
1.01	5.00	10	.06	.00	.05	5.	1.02	18.30	85	0.00	0.00	0.00	121.
1.01	5.30	11	.06	.00	.05	5.	1.02	19.00	86	0.00	0.00	0.00	113.
1.01	6.00	12	.06	.00	.05	6.	1.02	19.30	87	0.00	0.00	0.00	105.
1.01	6.30	13	.17	.00	.17	6.	1.02	20.00	88	0.00	0.00	0.00	98.
1.01	7.00	14	.17	.00	.17	6.	1.02	20.30	89	0.00	0.00	0.00	92.
1.01	7.30	15	.17	.15	.02	19.	1.02	21.00	90	0.00	0.00	0.00	85.
1.01	8.00	16	.17	.15	.02	55.	1.02	21.30	91	0.00	0.00	0.00	80.
1.01	8.30	17	.17	.15	.02	127.	1.02	22.00	92	0.00	0.00	0.00	74.
1.01	9.00	18	.17	.15	.02	248.	1.02	22.30	93	0.00	0.00	0.00	69.
1.01	9.30	19	.17	.15	.02	410.	1.02	23.00	94	0.00	0.00	0.00	65.
1.01	10.00	20	.17	.15	.02	594.	1.02	23.30	95	0.00	0.00	0.00	60.
1.01	10.30	21	.17	.15	.02	780.	1.03	0.00	96	0.00	0.00	0.00	56.
1.01	11.00	22	.17	.15	.02	955.	1.03	.30	97	0.00	0.00	0.00	53.
1.01	11.30	23	.17	.15	.02	1110.	1.03	1.00	98	0.00	0.00	0.00	49.
1.01	12.00	24	.17	.15	.02	1240.	1.03	1.30	99	0.00	0.00	0.00	46.
1.01	12.30	25	1.03	1.01	.02	1408.	1.03	2.00	100	0.00	0.00	0.00	43.
1.01	13.00	26	1.03	1.01	.02	1687.	1.03	2.30	101	0.00	0.00	0.00	40.
1.01	13.30	27	1.24	1.22	.02	2177.	1.03	3.00	102	0.00	0.00	0.00	37.
1.01	14.00	28	1.24	1.22	.02	2976.	1.03	3.30	103	0.00	0.00	0.00	35.
1.01	14.30	29	1.55	1.53	.02	4079.	1.03	4.00	104	0.00	0.00	0.00	32.
1.01	15.00	30	1.55	1.53	.02	5418.	1.03	4.30	105	0.00	0.00	0.00	30.
1.01	15.30	31	1.88	1.86	.02	6923.	1.03	5.00	106	0.00	0.00	0.00	28.
1.01	16.00	32	5.95	5.93	.02	8875.	1.03	5.30	107	0.00	0.00	0.00	26.
1.01	16.30	33	1.44	1.42	.02	11147.	1.03	6.00	108	0.00	0.00	0.00	25.
1.01	17.00	34	1.44	1.42	.02	13713.	1.03	6.30	109	0.00	0.00	0.00	23.
1.01	17.30	35	1.13	1.11	.02	16391.	1.03	7.00	110	0.00	0.00	0.00	21.
1.01	18.00	36	1.13	1.11	.02	18488.	1.03	7.30	111	0.00	0.00	0.00	20.
1.01	18.30	37	.08	.06	.02	19613.	1.03	8.00	112	0.00	0.00	0.00	19.
1.01	19.00	38	.08	.06	.02	19681.	1.03	8.30	113	0.00	0.00	0.00	17.
1.01	19.30	39	.08	.06	.02	18847.	1.03	9.00	114	0.00	0.00	0.00	16.
1.01	20.00	40	.08	.06	.02	17231.	1.03	9.30	115	0.00	0.00	0.00	15.
1.01	20.30	41	.08	.06	.02	15075.	1.03	10.00	116	0.00	0.00	0.00	14.
1.01	21.00	42	.08	.06	.02	12573.	1.03	10.30	117	0.00	0.00	0.00	13.
1.01	21.30	43	.08	.06	.02	10326.	1.03	11.00	118	0.00	0.00	0.00	12.
1.01	22.00	44	.08	.06	.02	8394.	1.03	11.30	119	0.00	0.00	0.00	11.
1.01	22.30	45	.08	.06	.02	6787.	1.03	12.00	120	0.00	0.00	0.00	11.
1.01	23.00	46	.08	.06	.02	5458.	1.03	12.30	121	0.00	0.00	0.00	10.
1.01	23.30	47	.08	.06	.02	4421.	1.03	13.00	122	0.00	0.00	0.00	9.
1.02	0.00	48	.08	.06	.02	3634.	1.03	13.30	123	0.00	0.00	0.00	9.
1.02	.30	49	0.00	0.00	0.00	3008.	1.03	14.00	124	0.00	0.00	0.00	8.
1.02	1.00	50	0.00	0.00	0.00	2496.	1.03	14.30	125	0.00	0.00	0.00	8.
1.02	1.30	51	0.00	0.00	0.00	2076.	1.03	15.00	126	0.00	0.00	0.00	7.
1.02	2.00	52	0.00	0.00	0.00	1724.	1.03	15.30	127	0.00	0.00	0.00	7.
1.02	2.30	53	0.00	0.00	0.00	1417.	1.03	16.00	128	0.00	0.00	0.00	6.
1.02	3.00	54	0.00	0.00	0.00	1151.	1.03	16.30	129	0.00	0.00	0.00	6.
1.02	3.30	55	0.00	0.00	0.00	967.	1.03	17.00	130	0.00	0.00	0.00	5.
1.02	4.00	56	0.00	0.00	0.00	902.	1.03	17.30	131	0.00	0.00	0.00	5.
1.02	4.30	57	0.00	0.00	0.00	842.	1.03	18.00	132	0.00	0.00	0.00	5.
1.02	5.00	58	0.00	0.00	0.00	786.	1.03	18.30	133	0.00	0.00	0.00	4.
1.02	5.30	59	0.00	0.00	0.00	733.	1.03	19.00	134	0.00	0.00	0.00	4.
1.02	6.00	60	0.00	0.00	0.00	684.	1.03	19.30	135	0.00	0.00	0.00	4.
1.02	6.30	61	0.00	0.00	0.00	638.	1.03	20.00	136	0.00	0.00	0.00	4.
1.02	7.00	62	0.00	0.00	0.00	595.	1.03	20.30	137	0.00	0.00	0.00	3.
1.02	7.30	63	0.00	0.00	0.00	555.	1.03	21.00	138	0.00	0.00	0.00	3.
1.02	8.00	64	0.00	0.00	0.00	518.	1.03	21.30	139	0.00	0.00	0.00	3.
1.02	8.30	65	0.00	0.00	0.00	484.	1.03	22.00	140	0.00	0.00	0.00	3.
1.02	9.00	66	0.00	0.00	0.00	451.	1.03	22.30	141	0.00	0.00	0.00	2.

1.02	9.30	67	0.00	0.00	0.00	421.	1.03	23.00	142	0.00	0.00	0.00	2.
1.02	10.00	68	0.00	0.00	0.00	393.	1.03	23.30	143	0.00	0.00	0.00	2.
1.02	10.30	69	0.00	0.00	0.00	366.	1.04	0.00	144	0.00	0.00	0.00	2.
1.02	11.00	70	0.00	0.00	0.00	342.	1.04	.30	145	0.00	0.00	0.00	2.
1.02	11.30	71	0.00	0.00	0.00	319.	1.04	1.00	146	0.00	0.00	0.00	2.
1.02	12.00	72	0.00	0.00	0.00	298.	1.04	1.30	147	0.00	0.00	0.00	2.
1.02	12.30	73	0.00	0.00	0.00	278.	1.04	2.00	148	0.00	0.00	0.00	2.
1.02	13.00	74	0.00	0.00	0.00	259.	1.04	2.30	149	0.00	0.00	0.00	1.
1.02	13.30	75	0.00	0.00	0.00	242.	1.04	3.00	150	0.00	0.00	0.00	1.
									SUM	24.29	22.62	1.66	267204.
										(617.)	(575.)	(42.)	(7566.37)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	19681.	15143.	5426.	1856.	267207.
CMS	557.	429.	154.	53.	7566.
INCHES		16.01	22.94	23.54	23.54
MM		406.60	582.75	597.86	597.87
AC-FT		7509.	10762.	11041.	11042.
THOUS CU M		9262.	13275.	13619.	13620.

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .50	RATIO 2 .40	RATIO 3 .30	RATIO 4 .20	RATIO 5 .10
HYDROGRAPH AT	ML.RES	8.80 (22.79)	1	9841. (278.66)	7873. (222.92)	5904. (167.19)	3936. (111.46)	1968. (55.73)
ROUTED TO	A1	8.80 (22.79)	1	9568. (270.93)	7653. (216.72)	5736. (162.43)	3805. (107.75)	1876. (53.12)
ROUTED TO	A2	8.80 (22.79)	1	9306. (263.52)	7405. (209.69)	5494. (155.58)	3566. (100.97)	1700. (48.14)
ROUTED TO	DAM	8.80 (22.79)	1	9200. (260.52)	7313. (207.07)	5436. (153.92)	3533. (100.04)	1655. (46.86)
HYDROGRAPH AT	DAM	8.60 (22.27)	1	10702. (303.04)	8561. (242.43)	6421. (181.82)	4281. (121.22)	2140. (60.61)
2 COMBINED	DAM	17.40 (45.07)	1	17942. (508.06)	14165. (401.11)	10385. (294.08)	6649. (188.27)	2973. (84.17)
ROUTED TO	DAM	17.40 (45.07)	1	17859. (505.70)	14090. (398.97)	10362. (293.41)	6641. (188.04)	5856. (165.82)
ROUTED TO	REACH1	17.40 (45.07)	1	17869. (506.00)	14120. (399.83)	10378. (293.87)	6615. (187.32)	6040. (171.03)

PLAN 1 STATION A1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9568.	92.1	19.50
.40	7653.	91.1	19.50
.30	5736.	90.1	19.50
.20	3805.	89.0	19.50
.10	1876.	87.5	19.50

PLAN 1 STATION A2

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9306.	84.6	20.00
.40	7405.	83.9	20.00
.30	5494.	83.0	20.00
.20	3566.	81.9	20.00
.10	1700.	80.7	20.50

PLAN 1 STATION DAM

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	9200.	63.7	20.00
.40	7313.	63.0	20.50
.30	5436.	62.2	20.50
.20	3533.	61.3	20.50
.10	1655.	60.2	21.00

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	61.00	61.00	66.30
STORAGE	341.	341.	496.
OUTFLOW	0.	0.	751.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	68.47	2.17	570.	17859.	5.52	19.00	14.00
.40	67.66	1.36	542.	14090.	4.04	19.50	14.50
.30	67.65	1.35	542.	10362.	1.52	19.50	15.00
.20	67.20	.90	526.	6641.	.96	19.50	15.50
.10	67.29	.99	529.	5856.	.94	18.00	17.00

PLAN 1 STATION REACH1

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.50	17869.	65.3	19.50
.40	14120.	64.0	19.50
.30	10378.	62.5	19.50
.20	6615.	60.6	19.50
.10	6640.	60.3	18.00